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Foremen's Conference

The third conference of foundry foremen which was recently held at Ashorne Hill gave ample evidence of both the popularity and usefulness of these functions. Up to now about 600 foremen have participated, though this figure may be on the high side because some have attended more than once. The industry should indeed feel grateful to the Institute of British Foundrymen for sponsoring this activity. Its success is obvious, as otherwise the attendance would tend to fall off instead of on all occasions taxing to the full the available accommodation. The organisation has in each case been of that high standard one expects from the Institute. Yet no matter how good an organisation is, it does not permit of one being in two places at once, and it so happened that for much of our stay we were empanelled in one room. Some firms overcame this difficulty by sending two or more of their foremen. They indeed were fortunate!

The three conferences have now discussed a number of subjects and no doubt the organising committee would welcome suggestions for fresh ones. There is no doubt that Mr. Wilkins' detailed exposition of the methods and relative costs of handling the raw materials from arrival on site to the cupola charging door aroused much interest, and perhaps indicates a worth-while trend for future contributions. Relationships, both human and with management, have now been adequately covered. Mr. Noel Newman in association with Mr. Buckley have dealt with the latter problem, basing their argument on the provision of a written constitution. All large concerns would do well to emulate this system as, in one case referred to during an informal discussion, no fewer than 1,000 foremen were on the staff.

The recently-held conference was opened by Mr. J. J. Sheehan, the national president of the Institute, whose happy phraseology so well expressed the aspiration of the organisers, that the maximum benefit was to be derived from informal chats. At those times, the members can talk about matters which interest them, and not those chosen by others. The exhibition of foundry sales films was the better appreciated because of Mr. Lloyd's introductory remarks, which placed the matter of this type of publicity in its proper perspective. The feature of film shows should be retained, as its popularity is noteworthy. We think this last conference was better, as it achieved a higher technical level than earlier ones. It is becoming more and more obvious that metallurgy is no longer the cardinal science of the modern foundry, it is giving place to mechanical engineering and, granted the opportunity, the average foundryman can not only appreciate this but make endless contributions to its progress. These conferences generate enthusiasm for experiment, as the foremen see and hear what has been done in both larger and smaller foundries. In recent times, talking "shop" has unfortunately been superseded by talking "politics," but the atmosphere at Ashorne Hill recaptured in full measure the absorbing interest that in truth does permeate the foundryman's job in life.

B

Institute of British Foundrymen

1952 *Conference Papers**

The Institute of British Foundrymen is prepared to receive offers of Papers for presentation at the 49th Annual Conference to be held in June, 1952. The invitation is issued earlier than is usual, as owing to printing difficulties it has been found necessary to arrange the Conference programme earlier than in past years, and manuscripts will be required at a correspondingly earlier date, *i.e.*, December 31, 1951.

Members and non-members who contemplate offering Papers are asked to communicate immediately with the secretary of the Institute, who will forward them a copy of the Institute's publication "Notes for the Guidance of Authors of Papers." It is desirable that all formal offers of Papers should be sent to the secretary not later than June 1, so that they can be considered by the meeting of the appropriate committee which will be held later in the month of June.

* Full details of this year's Papers are listed in the 1951 Conference Programme on page 311 *et seq* of this issue.

THIS AFTERNOON, the Mayor of Doncaster is to be presented with a copy of the sound film "The Bix Six," by its producer, Mr. Edward Cook. The film deals with the operation of half a dozen collieries in the Doncaster area. The film was made before they joined the State monopoly. The ceremony, to which a number of people prominent in the life of the town have been invited, is being held in the mayor's parlour at the Mansion House.

IN CONNECTION with the Festival of Britain, there is to be held at the County Hall adjoining the main London site an exhibition showing the history of the South Bank from Roman times. It is to be opened on May 9 and will continue every day—except Sundays—until September 29. Amongst local industries to be represented is that of ironfounding.

Latest Foundry Statistics

According to the February Bulletin of the British Iron and Steel Federation employment in ironfoundries showed an increase of 1,609 at the last counting day (January 6) over the previous month, the total now stands at 149,911. The gain in male labour was 1,699 so that there was a loss of 90 females. However the gains on the year have been 401 females and 3,720 males. At the moment about 6 per cent. of ironfoundry employees are female. At 18,608, steelfoundry employment showed a loss of 347 during the month and 539 as compared with a year ago. The weekly average production of alloy steel for castings during January showed a pleasing rise to 1,940 tons as against 1,790 in December, 1950, and 1,620 in January, 1950. Of ordinary grades the weekly average production of steel castings was 5,000 tons, an increase of 200 tons over the previous month.

The March issue of the Amalgamated Union of Foundry Workers reports the death of nearly 100 of their members, the average age being 68 years.

THERE IS PRINTED on page 320 of this issue a note to the effect that Dr. Pfeil, of the Mond Nickel Company, had been made a *Member* of Royal Society. An amended Press release informs us that Dr. Pfeil has been elected a *Fellow* of the Royal Society.

THE TILTMAN LANGLEY LABORATORIES, LIMITED, of Redhill Aerodrome, Surrey, have just published a 12-page brochure giving the history, activities and personnel of the company. It is mainly in the fields of aeronautics, gearing and grass drying that the company has been active.

WHEN 68 EMPLOYEES of David Brown Tractors, Limited, received perfect-attendance certificates at a dinner given by the company at Huddersfield on March 16, Mr. J. Whitehead, general manager, regretted that there was only one youngster among them. He hoped to see more people between 16 and 21 at future gatherings of the kind.

Defect in the Surface of the Casting. × 4 *Magnification.*

An Unusual Defect

The late Mr. James Ellis, a past-president of the Institute of British Foundrymen, often used to relate the story of the making of a casting which surprised everybody by the extraordinary amount of metal it required to fill the mould. When, with real difficulty the casting was stripped, it was found that in addition to the mould a rat run was also incorporated. Now from Mr. R. W. Miller, of Friberg, Saxony, comes the story of a very strange waster, which we illustrate. During the making of a light-alloy casting, a centipede was trapped in the mould, dashed to the most remote corner where it was "petrified," or perhaps better still, "metalli-fied." However, it was sufficient to cause a surface defect, shown in our picture at about four times magnification.

Oxygen in the Production of Carbon Steels from the Arc Furnace*

By A. C. Brearley

After first outlining the position at the works of K. & L. (Steelfounders and Engineers) Limited prior to the introduction of oxygen for decarbonisation of the melt, the Author reports his early trials, stressing the problems involved. Next, the observations arising from a visit to America are recorded and followed by accounts of further trials. In logical sequence, details of the processes now adopted at the foundry for both acid and basic electric steel melting are quoted and control features are emphasised. Finally, a balanced summary of economics to be secured is given, in addition to notes on the applicability of the processes to other than normal low-carbon steels.

THE STAFF OF K. & L. STEELFOUNDERS first interested themselves in the possible uses of oxygen some two years ago, driven to it by the increasing demands for liquid steel from the electric steel plant, which consisted of a 5-ton basic- and a 4½-ton acid-lined furnace. The basic furnace was powered with an 1,800 kva transformer and tapped about every 3½ hrs., whilst the acid in those days had only 1200 kva behind it, and thus, in spite of a shorter refining cycle, tapped only every 4 to 4½ hrs. In addition, because of this relatively low power (260 kva per ton) the acid furnace suffered from a further disadvantage that the bath was cold at melting-out and this, combined with the presence therein of some 15 to 20 points of silicon, made the starting of the boil a somewhat tardy operation and often enough it was forty minutes or even longer before the carbon had dropped from the "melting-out" figure of 0.25 per cent. or thereabouts to the required going-on figure of 0.13 per cent. One can imagine, therefore, the real interest evinced when it was disclosed by the American technical press that some 15 points of carbon could be removed in the acid furnace in 2 to 3 minutes by the use of oxygen.

Early Experiences

Unfortunately, however, there was no detailed description included of the "set-up" that was being used but at that time that did not appear to be a particularly important point. A few weeks later—when no real progress was being made—it was desired that a little more specific guidance had been provided. These early trials were in fact disappointing but are perhaps worthy of brief mention in so far as they do illustrate that the job did not go like clockwork from the very beginning.

The first attempts, then, were made using 2,000 cub. ft. cylinders of oxygen, a regulator, supplied by the British Oxygen Company, Limited, being fitted into the pipe line to decrease the bottle pressure to, and control it at, approximately 150 lb. per sq. in. at the point of entry to the lance. The lances themselves were constructed of ⅜ in. bore seamless tubing some 6 ft. in length, the end 4 ft. of which was protected by means of fireclay stopper sleeves, the gap between the sleeves and the tubing being filled with asbestos wool, whilst the ends and joints were plugged with an aluminous fireclay cement.

Looking back, the Author cannot imagine why such heavy protection was thought to be necessary, but that was how a start was made. The result was that the lance was too heavy to be held manually during the blowing operation and a lightweight stand was constructed, which could easily be positioned in front of the furnace door, to take the weight of the lance. The height of the stand was adjustable so that the angle of entry of the lance into the bath could be varied at will.

With this "set-up" the early trials were begun. The results, however, were, to say the least, rather disappointing. In spite of including some ore with the charge (so as to be removing silicon in the later stages of melting) and starting the oxygen injection as soon as the bath was clear, the rate of carbon removal was only slightly quicker than with normal ore practice (*i.e.* somewhere around 0.007 per cent. per min.). In addition, the oxygen consumption was in the 400 to 500 cub. ft. per ton range whilst the temperature "pick-up" as a result of the blow—one of the advantages claimed by the Americans—was only very slight, with the result that a pick-up of temperature had to be made after the blow had finished, with a further consequent delay of ten minutes or so. Furthermore, the "cold" blow was affecting the mechanical properties, both ductility and impact properties of the steel being adversely affected.

Consideration of the position, however, led to the conclusion that one of the troubles was too slow a rate of flow of oxygen, the maximum possible with the regulator supplied being of the order of 80 cub. ft. per min. This led to the use of two lances at once, each lance having its own 2000 cub. ft. cylinder of oxygen and its own regulator. The lance size too was changed from ⅜ in. bore to ½ in. and certainly an immediate improvement in the rate of carbon elimination was noted as a result of these changes, rates of up to about 0.02 to 0.03 per cent. per minute now being obtained. The weight of the lances and the time required for preparation were not particularly favourable, however, for this practice to be adopted as a routine.

*A Paper read before the Sheffield and Middlesbrough Branches of the Institute of British Foundrymen.

Oxygen Decarbonisation in Electric Steel Melting

American Practice

At this stage conditions became more propitious through a personal visit to the United States. This trip actually had been planned some months earlier and certainly before thought had been given to oxygen blowing, but, as it happened, the first process seen in the initial foundry visited was the oxygen blowing of an acid-electric heat, and so outstanding was it that an unforgettable impression was received.

As the Author reached the plant, the bath was just being sampled. The melter estimated his carbon by fracture, picked up a half-inch-bore lance which was protected by a thin coating of refractory cement, and connected through a pressure regulator to the foundry oxygen supply line. The oxygen was then turn on and the lance immersed in the molten bath to a depth of six inches or so. In half-a-minute the bath was boiling vigorously and at the end of three minutes the carbon had dropped from 0.32 to 0.18 per cent. The oxygen flow was at the rate of about 180 to 200 cub. ft. per minute and consumption was said to be of the order of 100 cub. ft. per ton at a flowing pressure of 80 lb. per sq. in.

Further Trials

Thus, immediately on return a regulator capable of passing up to 220 to 250 cub. ft. of oxygen per minute was obtained as quickly as possible and trials on the acid furnace still using 2000 cub. ft. cylinders, were recommenced. Troubles, however, were not completely over, one of the most persistent being that of finding a suitable coating for the lance. A dozen or so different materials were used ranging from core-sand mixes to chrome-magnesite cement before one was found—an aluminous fire-clay cement—which would stand up satisfactorily, the main trouble being of course, cracking and " flaking-off " of the protective coating as soon as the lance was put in the furnace, with the consequent relatively heavy consumption of piping and the necessity for frequently changing the 5 ft. lance used.

One other snag was the relatively cold bath (as compared with American practice) at melting and in this connection one must bear in mind the low transformer capacity per ton of charge (260 kva per ton) as against the American range of 600 to 700 kva. As a result of cold bath conditions the management found that the time in reaching the boil was still in excess of American practice, whilst on occasions the bath was still fairly cold at the end of the boil with consequent inferior mechanical properties for the steel produced. The addition of ore to the charge was then stopped so that there was some silicon present at melting out and this immediately improved things, for whilst a minute or so's delay occurred before the carbon flame commenced, the rapid oxidation of about 0.2 per cent. silicon did increase the bath temperature sufficiently to enable a freer, brisker boil to take place. In fact, on occasions elimination rates of 0.06 per cent. carbon per min. were realised. Quite noticeable too was the fact that as the bottle pressure dropped so did the rate of carbon elimination, this being due to the difficulty entailed in keeping a flow of 200 cub. ft. per minute or thereabouts as the bottle emptied.

It did appear that the melters had, by now, reached the stage where their teething troubles were more or less over, and the next step was the collection of data from fifty or so heats in order to establish more accurately the benefits to be derived from oxygen debarbonisation, with a view, of course, to assessing the economies to be gained from the installation of a pipe line to the furnace stage from the main oxygen storage plant. The results so obtained were, to say the least, most encouraging; the average time taken to reduce the carbon from an average " melt-out " figure of 0.26 per cent. to a " going-on " figure of 0.14 per cent. being 5 min.,

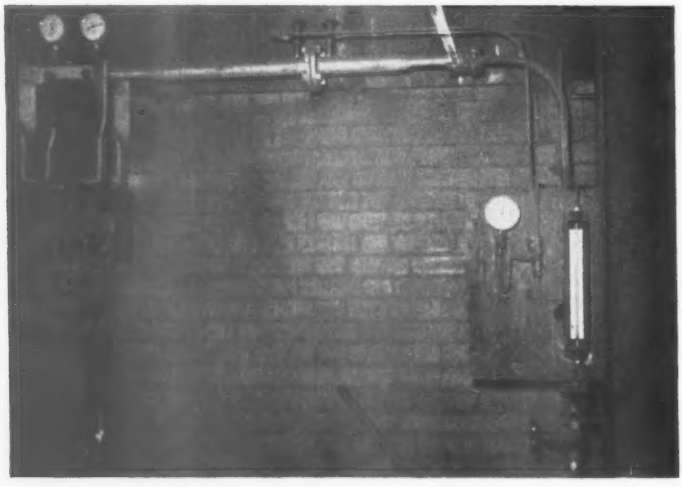

FIG. 1.—*Regulator and Manometer Set-up for the Oxygen Supply.*

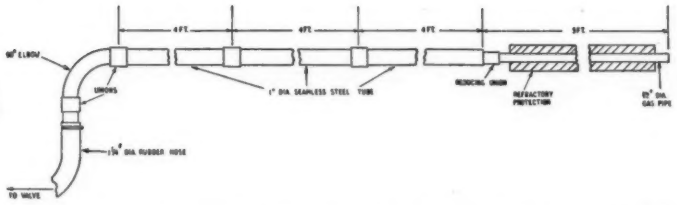

FIG. 2.—*Diagrammatic Sketch of Piping Arranged for Oxygen Injection.*

with an oxygen consumption of just over 200 cub. ft. per ton, and a saving in electricity of 50 kwh per ton.

During this period, the normal blowing pressure was 100 lb. per sq. in. but a few blows were made at 150 lb. per sq. in. and also at 60 lb. per sq. in. At the higher pressure, however, the turbulence of the bath appeared to be too great, resulting in a tendency for slag and metal to be ejected over the sill. The intensity of the flames coming through the door was also a little too high for comfortable working. Also, the rate of carbon elimination was no greater than that obtained at 100 lb. per sq. in. whilst the oxygen consumption per ton was higher. Unfortunately, during the 60 lb. per sq. in. trials much trouble was encountered with the regulator and the results were not particularly conclusive. The trend was, however, to a slightly lower rate of carbon elimination with about the same, or even slightly lower, oxygen consumption.

Present Operation on the Acid Furnace

The general inference from this work then appeared to be that a flowing pressure of 80 to 100 lb. per sq. in. or thereabouts was the optimum for this particular furnace, lance-size, etc., and as, by now, the staff were naturally most anxious for a permanent pipe-line to be laid this was done. By early last year the work was completed and since then each and every heat on the acid furnace has been "oxygen blown," the actual technique being as follows:

Oxygen is delivered from the central storage and evaporator house by means of a 1½ in. steel pipeline and is available at the furnace stage at a pressure of 150 to 180 lb. per sq. in. It is here reduced by means of a suitable reducing valve to a flowing pressure of 90 lb. per sq. in. and a manometer, for measuring the rate of flow and calibrated in terms of thousands of cub. ft. per hour is also provided as shown in Fig. 1. From this point, the oxygen passes through a 40-ft. length of 1¼ in. rubber hose to an elbow connection and thence to three 4 ft. lengths of 1 in. bore steel tube. This length of tubing is purposely built up in more than one section in case the lower part is damaged in the furnace by too deep an immersion of the lance proper or by this being inadvertently burnt away for the whole of its length, thereby again damaging the 1 in. bore pipe. A spare lower length of this piping is kept at the furnace so that a delay of but a minute or so is incurred if a change does become necessary. To the lower length of the 1 in. bore pipe is fitted a reducing socket into which is screwed the 5 ft. length of ½ in. bore lance (Fig. 2). This is constructed of gas-piping and is covered with a half-inch layer of aluminous fire-clay cement (Fig. 3). The lances are made up previously and a stock is kept at the furnace, the method of manufacture being to use a corebox to ensure an even thickness of coating the whole length and circumference of the lance. After removal from the box the lances are simply air-dried in the proximity of the ladle fires. Normally, only once lance per heat is required.

Furnace Operation

Turning now to furnace practice, the technique for a nominal 0.15 to 0.20 per cent. carbon steel is as follows:—

No ore is now included in the charge and as soon as the bath is "clear" melted a fracture sample for carbon is obtained. At this stage a carbon content of about 0.25 per cent. is sought but if the bath melts out higher, it is no matter for concern for at elimination rates of 0.05 per cent. per min. no appreciable delay is incurred by high-carbon melts. If it melts out appreciably lower, however, then it is brought back to this region either by means of pig-iron or by dipping the electrodes. A simple shield some 4 ft. 6 in. high and 4ft. wide and constructed of mild-sheet steel welded into a stand, (in order to protect the operator from the flames which come through the partly open door during the blowing operation), is positioned in front of the furnace door. The lance is then lifted on to the sill, the electrodes are raised well above the bath and the oxygen turned on. The lance is then immediately immersed in the bath to a depth of 4ft. 6in., and at an angle of 30 deg. from the horizontal and is moved slowly to and fro throughout the blow. Brown fumes are at first ejected and then some thirty seconds to one minute after blowing has started the boil starts. The typical carbon flame can then be seen (Fig. 4) and this increases in intensity for a short while (Fig 5) after which it begins to drop as the carbon reaches the 0.15 to 0.10 per cent. mark and at this point it should be emphasised that, though the boil is really brisk, it is never violent, *i.e.*, the stage is never reached where slag and metal or even slag alone is ejected over the sill. The approximate blowing time is calculated from consideration of the melt-out carbon figure, this estimate together with the appearance of the flame giving the melter a good idea when he is down to the 0.10 to 0.13 per cent. level. When this point is reached, the lance is removed and the oxygen turned off. A fracture sample is again taken and, if it shows a sufficiently low carbon (0.13 per cent. or under), the electrodes are lowered, the power is switched on and preparations

for refining begin. If the carbon be found to be still too high, then blowing is recommenced for the requisite period, after which the bath is sampled as before.

Control

Should the melter doubt the fracture figure, a Carbometer is available at the stage for check purposes. By the use of this magnetic method of carbon estimation, a reading may be obtained within 3 min. of the sample being drawn, thus eliminating the delay occasioned by even the quickest chemical methods which involve the accompanying necessity of obtaining drillings. With the experience the melters have by now gained, it is rarely that they are in doubt as to the carbon figure at the point of stopping the blow. The total blowing-time then normally ranges from 3½ to 5 min., the rate of carbon elimination being almost constant at a figure of 0.05 per cent. per min., as measured from the time the carbon flame appears and ranging from 0.03 to 0.05 per cent. per min. as calculated on the overall injection time.

During the injection, the bath temperature increases by anything from 50 to 100 deg. C.—as measured by an immersion pyrometer—nevertheless, no damage to the slag-line or to the roof and side-wall refractories occurs. In fact, slag-line attack (as compared to that found in previous ore-refining practice) is markedly reduced, presumably as a result of the short time of contact and the fact that the area of contact is spread over a few inches of the height of the bank instead of concentrated at one level as in ore practice. This " spread-over " results from the frothy nature of the slag which is brought about by the extremely rapid evolution of carbon monoxide.

Finishing

Returning to the melting practice itself, it still has to be recorded that as the electrodes are being lowered—*i.e.*, immediately following the blow—40 lb. of limestone is added to the furnace so as to keep the slag fluid and in good condition for slagging-off. Following this, 40 lb. of ferro-manganese is added for bath conditioning purposes and, as soon as this has " got through," half to two-thirds of the oxidising slag is run-off. A neutral slag of limestone, crushed firebrick and silica is then added to the bath and immediately fuses with what slag has been left on. Ferro-silicon and ferro-manganese are then added at short, fixed intervals and the furnace is then tapped, the whole operation from melt-down to tap averaging 20 min. This, compared to the " ore " time of 50 min., means valuable time savings, and this advantage, coupled with the fact that the firm has recently installed a 3,000-k.v.a. transformer on this furnace in place of the old 1,200-k.v.a., now means that there is a tap-to-tap cycle on 4½-ton charges of 1¾ hrs. as compared with that of 4 hrs. less than 12 months ago.

Even neglecting the time-saving aspect, there are other appreciable money savings, these being as shown in Table I.

TABLE I.—*Economics of Oxygen Lancing versus Oreing-down Practice for the Acid-electric Furnace (4½-ton Heats).*

Item.	Consumption per Ton of Liquid Steel.		Difference per Ton (Based on ore practice).	Savings (in Pence, per Ton (Based on ore practice).
	Ore practice.	Oxygen practice.		
Time (melt to slag off)	40 min.	10 min.	− 30 min. per heat	13 per cent. increase in production.
kwh	600	540	− 60 kwh	53
Electrodes	10.0 lb.	9.0 lb.	− 1 lb.	14
Iron ore	95 lb.	nil	− 95 lb.	47
Oxygen	nil	175 cub. ft.	+ 175 cub. ft.	Increase of 37
Lance (¼ in. dia. gas pipe)	nil	1.0 ft.	+ 1.0 ft.	Increase of 4
Refractory cement ..	nil	1.7 lb.	+ 1·7 lb.	Increase of 5
Ferro-manganese ..	40 lb.	35 lb.	− 5 lb.	13

Total savings effected by the use of oxygen, 6s. 9d. per ton.

This table should be self-explanatory apart from the savings in ferro-manganese, which result—as far as can be seen—from two factors.

FIG. 3.—*Refractory-coated Lance being Fitted into the End of the Pipe Assembly.*

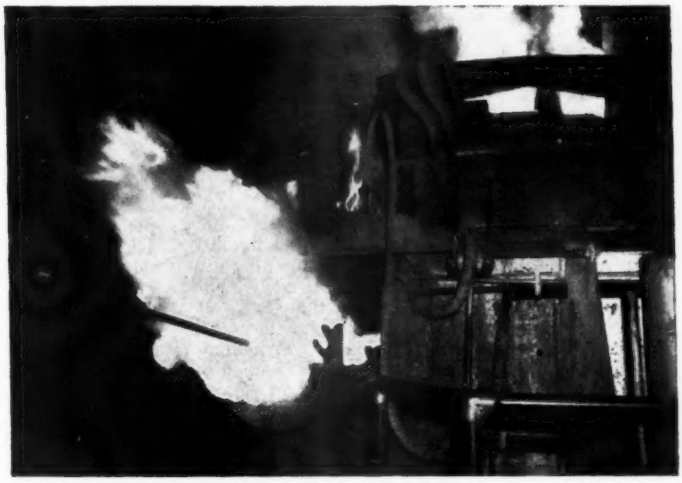

FIG. 4.—*Appearance of the Carbon Flame in the Early Stages of "Blowing."*

The first relates to the manganese content of the bath itself at the end of the boil, which with ore practice ranged from about 0.05 to 0.10 per cent., whilst with oxygen it is in the 0.15 to 0.20 per cent. range. The second factor is the iron-oxide content of the slag. With ore practice the FeO content of the slag at the end of the boil was in the 30 to 40 per cent. range. With oxygen it is in the 20 to 30 per cent. region. Even though it is the practice to slag-off after the boil, the Authors' men do not pull off all the slag, and thus the slag nowadays at the time of the ferro-manganese addition is lower in FeO than it was formerly, and thus the manganese losses are correspondingly lower (40 per cent. average as against 48 per cent. previously).

That, then, is the picture as at present seen on the acid-electric furnace, but turning to the basic electric, the position here will probably be of greater general interest, in so far as there are many more basic-lined furnaces in this country for electric steel than there are acid.

Present Practice on the Basic Furnace

At the outset, however, the Authors' firm was not so interested in the position on the basic furnace, because the time savings possibilities did not appear to be as great as on the acid furnace, in view of the fact that, like with most other operators of basic-lined furnaces, there was generally little difficulty in bringing the basic bath to a boil and, furthermore, once started, it was easy to maintain it at a reasonable rate. In fact, by means of adding ore to the charge during the later stages of melting, the bath was often almost "on the boil" at melting down, after which a feed of 50 lb. or so was sufficient to reduce the carbon from the melt-out figure of 0.25 to 0.30 per cent. to the going-on figure of 0.14 per cent.

Even so, some 25 min. had generally passed from melting-out to slagging off and, in the light of the findings on the acid furnace, there appeared to be no reason at all why an appreciable percentage of this time should not be saved on the basic. Accordingly, as soon as the pipe-line had been installed, work was started on the basic furnace, the technique employed being identical to that followed on the acid, *viz.*, no ore was added to the charge at all, the carbon at melting was again estimated by fracture, following which blowing began, using the same type of lance; the same oxygen pressure of 90 lb. per sq. in. and the same rate of flow of 200 cub. ft. per min.

This procedure has been adopted for normal practice, one slight difference being observed in so far as the carbon flame starts almost immediately, as against a wait of a minute or so in the acid melting process. There appears to be no measurable difference, however, in the rate of carbon elimination, this again being approximately 0.05 per cent. per min. as it was on the acid, but, due doubtless to the fact that no silicon has to be removed, the over-all blowing time is generally in the 2½ to 3½ min. range as against the previously quoted figures of 3½ to 5 min. for the acid. Oxygen consumption is therefore rather less, the average figure obtained over these last few months, being 120 cub. ft. per ton, equivalent to a consumption of approximately 10 cub. ft. per point of carbon removed per ton as compared with 14 cub. ft. for the acid.

Again, as one would expect from the lower quantities of silicon to be removed during the blow and the reduced oxygen consumption, the increase in bath temperature during blowing is not as great on the basic furnace as on the acid. It is, however, still appreciable, being of the order of 30 to 60 deg. C. under the particular conditions obtaining and the bath now tends to be a little warmer at "slagging-off" than it was with ore practice. Furthermore, this is in spite of the fact that the electrodes are raised and the power off during the blowing operation.

Oxygen Decarbonisation in Electric Steel Melting

Control and Finishing for Basic Operation

After the lance has been withdrawn, a sample is taken for "fracture carbon" and this estimate together with the flame appearance provides an accurate guide (within ± 0.03 per cent.) as to the actual carbon content. If the carbon is not reduced to the desired figure of 0.10 to 0.15 per cent, then further blowing is, of course, carried out but it is very rarely found that more than one blow is required. When "blowing" is completed, 50 lb. of ferro-manganese is added to the bath and allowed to boil through, after which a sample is drawn for laboratory estimation of manganese. The oxidising slag is then pulled off and 80 lb. of 45 per cent. ferro-silicon (*i.e.* 0.30 per cent. silicon) is added to the bath, this being followed immediately by a normal basic-electric refining slag mix. It will be noted from the above remarks that a laboratory estimation for manganese is carried out on the basic operation whereas on the acid it is not, the reason for this difference being the greater variation—from heat to heat—in manganese content at the end of the "boil" with the firm's basic practice than with the acid, thus making uncertain the maintaining of a 0.6 to 0.8 per cent. manganese range unless chemical estimation be employed. No delay is occasioned by this estimation, however, as the manganese result is, of course, received well before the heat is ready for tapping.

With regard to refining procedure, no change has been found to be necessary by the adoption of oxygen blowing, there being, if anything, a slight reduction in the average refining time due to the consistently good condition of the bath at "slagging-off." The times at present average 20 min. from the end of "slagging-off" to the obtaining of a white falling slag and 35 to 40 min. for the whole refining cycle, *i.e.* from the end of "slagging-off" to tapping.

Phosphorus

The only draw-back—if such it can be termed—that the staff has encountered on this furnace by the adoption of oxygen decarbonisation is the fact that the final phosphorus content tends to be about 0.005 per cent. higher than with oring practice (*i.e.* 0.030 to 0.040 per cent. as against 0.025 to 0.035 per cent.). As it has already been noted on the acid furnace that, at the end of the blow, the slags were lower in FeO than they were with ore practice it was thought, at first, that a similar state of affairs might exist on the basic; that, it was felt, would have explained the higher phosphorus contents. Chemical analyses of a number of slag samples taken at the end of the blow have, however, dispelled this theory, the FeO contents being identical with those obtained on "ored" heats, the bath carbons being the same in all cases.

The lime-silica ratios were similar too, both being in the range from 3:1 to 4:1. Even so the P_2O_5 contents of the ore slags were slightly higher than those of the oxygen-blow heats, and the opinion now is that the cause may well be the result of the combination of the less-oxidising conditions now prevailing during the later stages of melting—due to the fact that no ore is charged—together with the higher bath and slag temperatures that now obtain towards, and at the end of, the boil, it being well known, of course, that low bath-temperature does favour phosphorus removal.

Where specifications permit 0.05 per cent. phosphorus, the slight increase noted is of no consequence but it is felt that some revision of practice might be necessary were for instance, 0.03 per cent. maximum phosphorus called for. Having mentioned this possible draw-back, all that now remains is to cite the advantages found on the basic furnace during the eight months of oxygen

FIG. 5.—*Increased Length and Intensity of the Carbon Flame—to be seen when the "Blow" is progressing well.*

blowing and these again are shown in tabular form (Table II).

TABLE II.—*Economics of Oxygen Lancing versus Oreing Down Practice (b) Basic Electric Furnace (5-ton Heats).*

Item.	Consumption per ton of liquid steel.		Difference per ton (based on ore practice).	Savings (in pence) per ton (based on ore practice).
	Ore practice.	Oxygen practice.		
Time (melt to slag off)	25 min.	10 min.	− 15 min per heat	7 per cent. increase in production.
kWh	690	660	− 30 kWh	27
Electrodes	11.0 lb.	10.0 lb.	− 1.0 lb.	14
Iron ore	30 lb.	nil	− 30 lb.	15
Oxygen	nil	120 cub. ft.	+ 120 cub. ft.	Increase of 25
Lance (¼-in. dia. gas pipe)	nil	0.6 ft.	+ 0.6 ft.	Increase of 2
Refractory cement ..	nil	1.0 lb.	+ 1.0 lb.	Increase of 3

Total savings effected by the use of oxygen, 2s. 2d. per ton.

The items quoted are entirely self-explanatory and readers, no doubt, have already noted the omission of the ferro-manganese line, which appeared in the Table summarising the acid-furnace position. The reason, actually, is not far to seek, there being no savings of this item on the basic electric furnace, so far as can be established.

Other Grades of Carbon Steel

Whilst, because of its universal popularity, the Author has concentrated so far on the manufacture, by means of oxygen blowing of 0.15 to 0.20 per cent. carbon steel, it is desired to make quite clear that the firm is, of course, using the same technique for other grades of carbon steel with the same degree of success. For instance, the so-called "high-magnetic permeability steel" with its low (0.12 per cent. or under) carbon and manganese contents is not a popular quality with electric steel makers, as distinct from those using converter plants, because of the time that is often taken up in boiling the carbon down to 0.08 per cent. or so. With oxygen, however, this difficulty is completely eliminated, there being no trouble encountered in either furnace in dropping to such low figures. The firm is also regularly blowing the higher-carbon qualities (*i.e.* the 0.40 to 0.45 and the 0.45 to 0.50 per cent. carbon grades) the practice here being to add to the charge sufficient anthracite to enable the bath to melt out some 0.10 to 0.15 per cent. above the required "going-on" figure.

On melting, the carbon is estimated as closely as possible by fracture and oxygen is then injected into the bath in the usual manner. Blowing time is based on an elimination rate of 0.07 per cent. per min., the starting point being the appearance of the carbon flame. It will be noted that the rate of carbon drop at this bath level of 0.40 per cent. is somewhat higher than that obtained at bath carbons of 0.15 to 0.25 per cent. As a result, the blowing time is only of the order of one minute on the basic furnace and two minutes—because of the higher silicon content—on the acid, after which a further fracture sample is taken to check, roughly, that the carbon is almost down to the required "going-on" figure. When this stage has been reached, a further bath sample is obtained, this time for laboratory determination of carbon and manganese and the bath is allowed to carry on boiling until the carbon figure is received (*i.e.* for about ten minutes). After the necessary ferro-manganese addition, the bath is then slagged and refining is carried out in the manner previously described for the particular furnace in question.

The reasons for the chemical estimation here are two, the first being that the specified ranges for carbon and manganese are quite narrow on the 0.40 per cent. and 0.50 per cent. carbon steels. In addition, estimation of carbon to within three or four points by the fracture method is somewhat difficult at these relatively high-carbon levels and the risk entailed by relying on fracture-carbon alone is therefore too great. The time savings therefore on these qualities are not as great as on the 0.20 per cent. carbon grades, even so they are still very worth-while.

Summary

That concludes the story of personal experiences to date with oxygen lancing but for completeness sake it is deemed desirable to summarise the principal findings, as follows:—

1.—Time savings average 30 min. per heat on the acid furnace and 15 min. on the basic.

2.—Neglecting any savings made possible by this increased output, economies of about 7s. per ton of liquid steel on the acid and 2s. per ton on the basic are being secured.

3.—No increased wear-and-tear of refractories on either furnace has been noted by the adoption of oxygen decarbonisation. In fact, as already remarked, slag-line erosion on the acid furnace has decreased with a consequent reduction in fettling-times.

4.—No deterioration in steel quality—either from a porosity or mechanical-property point of view—has been detected.

5.—The necessity for stocking and handling iron ore—at the Author's firm some 8 tons per week—has been eliminated.

6.—Hold-ups, expensive in both time and money, resulting from high-carbon melts also have been aliminated. Such melts, on plants with little or no melting capacity in reserve can and do play havoc with the melting programme, with the inevitable result that the foundry becomes "box-bound" and valuable production is lost, to say nothing, of course, of the wear and tear on both management's and mens' tempers.

Acknowledgments

Finally, the Author desires to thank his Company for the permission they so readily granted for all the data included in this Paper to be presented; his director, Mr. R. F. Ottignon, without whose ideas and energies there would have been no experiences or data on which a Paper could have been based; and the melting-shop superintendent, Mr. Crankshaw, who has had the real job of so successfully translating into practice any "pipe-dreams" that some of his colleagues may have had a couple of years ago.

Book Reviews

Die Casting. By H. H. Doehler. Published by the McGraw-Hill Publishing Company, Aldwych House, London, W.C.2. Price 68s.

This book is American in origin and the author is the chairman of the Board of Directors of one of the leading American die-casting companies and is undoubtedly an authority on his subject. He was one of the pioneers of the industry and it is interesting to note that he patented his first die-casting machine as early as 1905, this is now an exhibit in the Smithsonian Institute.

In reviewing this book it should first be mentioned that, owing to a difference in nomenclature in the die-casting industry of this country and the United States, the title may be slightly misleading to a British reader, the term "Die Casting" in the U.S.A. is restricted to what is known to us as "pressure die-casting," the process of gravity die casting being known in America as "permanent-mould casting."

It is very evident from a first perusal of this publication, that the book is of a very comprehensive nature and covers every step from the preliminary estimating of the cost of production of the casting, down to the final inspection of the finished part; indeed, the Author goes even further than the production and fettling of the casting and gives a considerable amount of useful information of various finishes that can be applied, covering mechanical, chemical, electrolytic and electroplating finishes, also paint and other organic applied finishes.

The Author first traces the history of the die-casting machine from the early manually-operated plunger types through the various stages and improvements up to the modern machine; he follows this with a very careful discussion of all aspects of die design from the simplest single-cavity die to the most elaborate multi-impression tools and includes some of the largest and most complicated dies yet made, dealing at the same time with all important points such as die joints, cores, slides, gates and runners.

The chapter dealing with die steels is handled in a very masterly fashion and contains a large amount of exceedingly useful information and it is pleasing to note that every statement made is supported by giving reasons for making these statements; the same remarks can be applied to subsequent sections dealing with the fettling, finishing, and machining of the die castings.

The section dealing with die-casting alloys may, at first glance, appear to the British reader to be of little direct value in that the American die-casting alloys differ widely from the British standards; therefore, some of the information can only be of passing interest. At the same time, it will be noted that there is a wealth of useful information contained in this section dealing with the effect of various alloying constituents on the production problem of die casting, and also some useful remarks on troubles that may be experienced due to the inclusion of certain impurities.

Every section of the book has been carefully illustrated with photographs, diagrams and graphs, and many of the diagrams are so well drawn that they are capable of telling their own story almost without reference to the accompanying text.

In the preface, the Author states that the purpose of the book is to make readers, whether they be students, production engineers or product designers, feel aware of the possibilities of die castings by discussing the present-day production methods and design techniques and also by pointing out the probable trends in the near future, and a brief study will convince anyone that he has achieved his purpose. He has gone further, in that "Die Casting" is a useful reference book for the die-casting technician.

A. P. F.

Metallurgical Thermochemistry. By O. Kubaschewski and E. LL. Evans. Published by Butterworth-Springer, Limited, Bell Yard, Temple Bar, London, W.C.2. Price 36s. post free.

Reviewed by Professor H. O'Neill.

Foundrymen comprise those who have come up "the hard way" and those who have survived the still harder trail of advanced technical instruction. The latter may have taken a degree which will probably have involved lectures on thermodynamics in the chemistry department. This book will be straightforward and enjoyable reading for the second type of foundryman. Free energy is the driving force of chemical reactions, and scientific study of the latter involves kinetic and thermochemical considerations. Only the latter are dealt with in the book and the Preface disarmingly states that "thermochemistry is at present fashionable in metallurgical circles, and care should be taken to view it in its correct proportion." The Authors state that their work is an introduction to the subject and also a book of reference. This is borne out by examination of the 368 beautifully-printed pages, 151 of which consist of tables of data with 333 references to the literature. Many must take the data for granted, but an expert tells the reviewer that the heat of sublimation for graphite given as 194 on p. 266 should be replaced by the modern value of 170. The illustrations are good. The metallurgical research chemist will very much appreciate the fare which is provided, and the Authors show that the subject is of real use to the scientist engaged in process work by including examples of thermochemical treatment of metallurgical problems.

The metallurgist who is familiar with the earlier publications of Tammann and Schenk will realise that this type of book follows the path which they ascended. Most of us remember how Le Chatelier's Principle was applied to the conditions for working a blast furnace. Reactions in the cupola can be handled on the same lines. One realises that in the process of making malleable cast iron, scientific principles are involved when the graphite precipitates. Gaseous malleablisation could be treated on these principles. On page 338, the Authors give us a typical metallurgical example of this work by treating the question of whether pure iron can be kept molten in a magnesia crucible without oxygen pick up. The few lines of thermochemical calculation which they supply answer the question in the negative. Those of us who remember that silicon was reduced from the pot walls during steel melting in the old Sheffield crucibles, and that silicon was sometimes reduced from the slag in the old open-hearth furnace at the University of Sheffield will appreciate that these matters can now be forecast from an armchair, with the aid of calculations of this type.

A few aspects of the book will be of use to the foundry technologist; the de-oxidation of steel receives attention and Chapter III, section (4), deals with heats of formation. Exothermic compounds for use in moulds and ladles therefore come into the picture, and the principles could be applied to the de-gassing of light alloys. One notices no mention of the reactions which may be involved in the successful melting and de-gassing of bronze, and the name of Lepp does not appear in the name index. It is probable therefore that a foundry scientist could take the matter still further by providing more examples which would be of direct use to his colleagues.

HUGH O'NEILL

Institute of British Foundrymen

Annual Conference Programme

Newcastle-upon-Tyne, June 12 to 15, 1951

The 48th Annual Conference of the Institute of British Foundrymen will be held at Newcastle-upon-Tyne from June 12-15. At this Conference Mr. Colin Gresty, President-designate, will be inducted into the Chair. The Conference is being organised by the Newcastle-upon-Tyne branch and the arrangements are being made by a Committee of the branch under the chairmanship of Mr. C. Lashly, and this Committee has undertaken the organisation of the works visits and social arrangements; bookings, however, will as usual be effected through the General Office of the Institute in Manchester. Newcastle-upon-Tyne is the centre of an important industrial area and there is an exceptional number of interesting foundries which will be open for inspection. The city is within easy access of the Northumberland coast and is convenient for those people who wish to combine their attendance at the Conference with a holiday.

Members are requested to note the following:—

(1) *Hotel Accommodation.* Newcastle is an industrial city and usually all its hotels are full every night in the middle of the week. All the hotels have agreed to place a proportion of their rooms at the disposal of the Institute, but in every case early booking is essential in order to secure this accommodation. A number of well-appointed private hotels in the near suburbs offer excellent accommodation, and attention is particularly directed to the hotels in the coastal area, which is accessible from Newcastle by an excellent electric train service. All hotel accommodation should be booked direct to the hotel, with the exception of the Royal Station Hotel.

(2) *Meeting Accommodation.* Meetings will be held in the rooms of the Literary and Philosophical Society and in the Neville Hall, which adjoins the Literary and Philosophical Society. Both buildings are close to the Central Station.

(3) *Works Visits.* The Institute is particularly indebted to the companies who are inviting members to inspect their works. Most of these companies are also extending hospitality for luncheon and for tea.

(4) *Ladies.* In addition to the items arranged specially for ladies, they are also invited to accompany members at various social functions as indicated on the general programme.

(5) *Preprints* of papers to be presented to the Conference will be available to all members on request whether they are attending or not. Application for copies may be made immediately.

(6) *Punctuality.* Punctuality is essential and members and ladies are requested to attend all functions at least five minutes before the advertised times.

(7) *Reply Forms.* It is essential that those who intend to participate should return appropriate forms as soon as possible and in no case later than May 19.

(8) *Tickets.* Unless requested to the contrary, tickets will be sent by post in advance of the Conference together with a copy of the Conference Handbook in which final and fuller details of the programme will be included. Tickets should be carefully checked upon receipt. Distribution of tickets will not be commenced until the latter part of May, irrespective of the date of receipt of the reply forms.

(9) *Conference Office.* The Conference Office will be established on Tuesday, June 12, in the Lower Committee Room on the ground floor of the Literary and Philosophical Society, which is near to the Central Station and to the Royal Station Hotel. Communications prior to this date should be addressed to the Institute's head office, St. John Street Chambers, Deansgate, Manchester, 3. The telephone number of the Conference Office is Newcastle-upon-Tyne 23724.

Provisional Arrangements

Tuesday, June 12

Afternoon: Council and Committee meetings at the Royal Station Hotel. Open to Council and Committee members only who will receive particulars later. All members and ladies make their own arrangements for dining. 8 p.m. to midnight: Reception and dance by invitation of the Lord Mayor of Newcastle-upon-Tyne and the Lady Mayoress on behalf of the City Council, and supported by the Sheriff, at the Old Assembly Rooms, Westgate Road. Welcome by the Lord Mayor and Lady Mayoress. (Members and ladies; evening dress optional.)

Wednesday, June 13

9.15 a.m.: Annual General Meeting at the Literary and Philosophical Society, Newcastle. (Members only.) Presentation of awards. 11 a.m.: Presidential Address by Mr. Colin Gresty. 11.30 a.m.: Edward Williams Lecture—"The Properties of Materials and the Engineering Uses of Cast Metals" to be delivered by Dr. R. W. Bailey, D.SC., F.R.S., M.I.MECH.E. (Metropolitan-Vickers Electrical Company, Limited. 12.30 p.m.: Adjourn. 1 p.m.: Luncheon. Old Assembly Rooms, Westgate Road, by invitation of the Newcastle-upon-Tyne branch. (Members and ladies.) 2.15 p.m.: Technical Sessions. 4.30 p.m.: Conference adjourns. Members pass to Royal Station Hotel for Buffet Tea (by invitation). 7 p.m.: Reception by the President and Mrs. Gresty at the Old Assembly Rooms prior to the Annual Dinner. 7.30 p.m. to 1 a.m.: Annual Dinner at the Old Assembly Rooms followed by dancing. (Members and ladies; evening dress; decorations).

Thursday, June 14

9.30 a.m.: Technical Sessions. 12.30 p.m.: Conference adjourns. 1 p.m.: Luncheon at the Old Assembly Rooms, Westgate Road. 2.30 p.m.: Technical Sessions. 4.30 p.m.: Conference adjourns. Members pass to Royal Station Hotel for Buffet Tea (by invitation). Members and ladies make their own arrangements for dinner this evening and it is suggested they give notice beforehand to their hotels of their intention to dine. 8.30 p.m.: Entertainment and informal social evening at the Old Assembly Rooms, Westgate Road. Light refreshments (by invitation). (Not evening dress.)

Friday, June 15

Members may participate in *one only* of the following visits or groups of visits. Motor coaches will depart

Annual Conference Programme

from Central Station (west of Portico) at the times given:—

(1) 9.15 a.m.: C. A. Parsons & Company, Limited, Heaton. Makers of turbo-generating plant; modern heavy and mechanised foundries. Luncheon at Station Hotel by kind invitation of the Newcastle branch. Return to works after luncheon. Tea by kind invitation of the Company. Arrive Central Station on return about 5.30 p.m. (2) 9.15 a.m.: Consett Iron Company, Limited, Consett. Iron and steel works. Visit to blast furnaces only. (Steel works undergoing extensive alterations.) Luncheon at 1 p.m., by kind invitation of the Company. Leave Consett on return at 2.30 p.m., arriving Newcastle (Central Station) about 3 p.m. Remainder of afternoon free. (3*a*) 9.20 a.m.: Sir W. G. Armstrong Whitworth & Company (Ironfounders), Limited, Close Works, Gateshead-on-Tyne. (Morning.) Luncheon at Springfield Hotel at 12.30 by kind invitation of the firm. 2.15 p.m.: Leave Springfield Hotel for:—(3*b*) Heaton Foundry Company, Limited, Team Valley, Gateshead. (Afternoon.) Tea at Stewart's Restaurant by kind invitation of the firm. Arrive Central Station on return about 5.30 p.m. (4*a*) 9.20 a.m.: Clarke, Chapman & Company, Limited, Victoria Works, Gateshead-on-Tyne. Steam and electric ships' deck and engine room auxiliaries. Luncheon at 1 p.m., by kind invitation of the Company. Depart from Clarke, Chapman's Works at 2.10 p.m. for:—(4*b*) Jarrow Metal Industries, Limited, Jarrow. Steelfounders. Tea by kind invitation of the Company. Arrive Central Station on return about 5.30 p.m. *or* (4*c*) Depart from Clarke, Chapman's Works at 2.15 p.m. for:—Hawthorn, Leslie & Company, Limited, St. Peter's Works, Newcastle-on-Tyne. Marine engineers. Tea by kind invitation of the Company. Arrive Central Station on return about 5 p.m. (5*a*) 9.30 a.m.: North Eastern Marine Engineering Company (1938), Limited, Wallsend-on-Tyne. Luncheon at 12.45 by invitation of the Company. Depart from North Eastern Marine Engineering Company's works at 1.50 p.m. for:—(5*b*) A. Reyrolle & Company, Limited, Hebburn-on-Tyne. Electrical engineers. Switch gear manufacturers. Tea by kind invitation of the Company. Arrive Central Station on return about 5.15 p.m. *or* (5*c*) Depart from North Eastern Marine Engineering Company's Works at 2 p.m. for:—Noble & Lund, Limited, Felling-on-Tyne. Engineers and machine tool makers. Tea by kind invitation of the Company. Arrive Central Station on return about 5.15 p.m. (6) 9.45 a.m.: Vickers Armstrongs, Limited, Elswick Works. Luncheon by kind invitation of the Company. Arrive Central Station on return about 3.50 p.m. Tea at the Royal Station Hotel, by invitation of the branch. 7.30 p.m. for 8 p.m. to 1 a.m.: Dinner Dance (members and ladies) at the Old Assembly Rooms, Westgate Road. (Evening dress optional.)

Ladies' Programme

Tuesday, June 12

8 p.m. to 12 p.m.: Reception by Lord Mayor of Newcastle-upon-Tyne and the Mayoress at the Old Assembly Rooms, Westgate Road. (Members and ladies; evening dress optional.)

Wednesday, June 13

10.45 a.m.: Morning Coffee in the Banqueting Room of the Royal Station Hotel. 11.15 a.m. to 12.15 p.m.: Mannequin parade at the Royal Station Hotel by John Moses & Company, Limited, Grainger Street, Newcastle-upon-Tyne. 1 p.m.: Luncheon with members at the Old Assembly Rooms. Afternoon free. 7 p.m.: Reception by the President and Mrs. Gresty, prior to the Annual Dinner. 7.30 p.m. to 1 a.m.: Annual Dinner at the Old Assembly Rooms followed by dancing (evening dress).

Thursday, June 14

Either of the following excursions:—

9.30 a.m.: (1) Coaches leave west side of Central Station portico for excursion to Alnwick, *via* Morpeth and Rothbury. 12.30 p.m.: Luncheon at County Hotel, Morpeth, by invitation of the Newcastle branch. 1.45 p.m.: Proceed to Alnwick. Ladies who so desire may inspect Alnwick Castle, residence of Duke of Northumberland. 4 p.m.: Tea at Louvre Café, Alnwick. Arrive at Newcastle Central Station on return about 5 p.m. Ladies staying at the coast will proceed by special coach leaving as follows: Grand Hotel, Tynemouth, 9.15 a.m.; Bay Hotel, Cullercoats, 9.20 a.m.; Esplanade Hotel, Whitley Bay, 9.25 a.m.; joining Newcastle party at Morpeth at 10.10 a.m. On return arrive at coast resorts at approximately 5 p.m. *or* (2) Excursion to Durham. 10 a.m.: Leave Central Station (west of Portico) for Durham. Arrive 11.30 a.m. 1 p.m.: Luncheon at Castle Hotel, Durham. 3.30 p.m.: Depart for Newcastle. 4.30 p.m.: Tea at Royal Station Hotel, Newcastle. 7.30 p.m.: Entertainment and informal social evening at the Old Assembly Rooms, Westgate Road (not evening dress).

Friday, June 15

Ladies may participate in one only of the following visits. Depart from Central Station (west of Portico) at the times named:—

9.45 a.m.: (1) Jackson, the Tailor, Limited, Gateshead-on-Tyne. 9.50 a.m.: (2) Thomas Hedley & Company, Limited, soap manufacturers, Newcastle-upon-Tyne. 9.50 a.m.: (3) British Engines, Limited, making domestic cake mixers, etc., All parties will take luncheon at the Park Hotel, Tynemouth, at 1 p.m., then proceed to coast where the afternoon is free. Tea at Park Hotel at 4.30 p.m., ladies residing at Newcastle depart at 5 p.m., arriving Central Station about 5.30 p.m. 7.30 p.m. for 8 p.m. to 1 a.m.: Dinner Dance at the Old Assembly Rooms, and entertainment (evening dress optional).

Programme of Papers

Wednesday, June 13

2.30 p.m. to 4.30 p.m. Two simultaneous sessions.

SESSION A (at the Literary and Philosophical Society, Newcastle-upon-Tyne): No. 995, "Thermal Considerations in Foundry Work," by Dr. V. Paschkis (Exchange Paper from the American Foundrymen's Society); No. 996, "Study of the Industrial Applications of Platinum/Platinum-Rhodium Thermocouples," by M. Chaussain (Exchange Paper from *l'Association Technique de Fonderie*); No. 997, "Factors Affecting the Solubility of Carbon in Iron," by R. V. Riley, PH.D., B.SC., A.I.M. (Member).

SESSION B (at the Neville Hall, Newcastle-upon-Tyne): No. 998, Report and Recommendations of Sub-committee T.S. 30—Synthetic-resin Corebinders; No. 999, "Patternmaking—Some Present-day Practices," by B. Levy (Member); No. 1000, "Making an Ingot Mould in India," by S. N. Rao.

Thursday, June 14

9.30 a.m. to 12.30 p.m. Two simultaneous sessions.

SESSION C (at the Literary and Philosophical Society, Newcastle-upon-Tyne); No. 1001, "Production of Heavy Castings for Electrical Generating Equipment," by N. A. Charlton (Member); No. 1002, "Manufacture of Propellers and other Castings in a Heavy Jobbing Foundry," by C. W. Stewart; No. 1003, "A System of Studying Casting Defects," by G. W. Nicholls (Member) and D. T. Kershaw (Associate Member).

(*Continued on adjoining page, foot of column* 2)

Lancashire Branch Dinner

About 200 members, visitors and their ladies attended the annual dinner and dance of the Lancashire branch of the Institute of British Foundrymen at the Grand Hotel, Manchester, on February 3.

The dinner was preceded by a whist drive, after which a reception was held at which Mr. and Mrs. D. Fleming, Mr. and Mrs. Colin Gresty, Dr. and Mrs. Dadswell received the members and guests. Mr. J. Jackson and Mr. G. C. Studley officiated as reception stewards, and Mr. S. Brooks acted as toast master. Unfortunately, Mr. J. J. Sheehan, B.SC., president of the Institute, Mrs. Sheehan, and Dr. J. G. Pearce, director of the British Cast Iron research Association, were unable, owing to illness, to be present, and it was unanimously resolved that a message of sympathy be forwarded to them expressing a sincere hope for their speedy recovery from influenza.

After the loyal toast had been honoured, the toast of "The Lancashire Branch" was proposed by MR. COLIN GRESTY, senior vice-president of the Institute. He explained that owing to the regrettable absence of Mr. J. J. Sheehan, he found himself to be acting the part of an understudy at very short notice. He had known of the branch and been acquainted with many of its members for a considerable number of years. Not only was the Institute of British Foundrymen moulded and cast in Manchester—(Hear, hear)—but it was a remarkable good casting, and was one of those remarkable castings which became better and better and stronger and stronger as the years went on. It did not suffer from fatigue.

He said the branch, now embracing some 600 members, had doubtlessly discussed the Report of the Grey Iron Founders' Productivity Team. This was intended to inform foundrymen how to obtain better production, and as to what means were adopted in the U.S.A. to achieve this object. He regretted to state, however, that personally he had not been able to discover any satisfactory reference to the major problem which confronted the founding industry in this country, namely, how to make more and more castings when there was less and less fuel and less and less material available. However, whatever future problems might arise, there was no doubt that if they were discussed in the branches and with their friends, they would certainly be solved sooner or later.

After paying a tribute to Mr. T. Makemson, M.B.E., and to Mr. Fleming, the branch-president, whose name he coupled with the toast, the latter replied.

MR. FLEMING said the mention of increased productivity reminded him of an example of zeal misdirected. The occasion occurred in a local foundry when they wished to have more productivity in the core shop and the stoves were not doing so well. They could not get quick delivery with the new type of stove, so they rebuilt the fire grate. Their enthusiasm was so great, and the job was done so efficiently, that the very first time they lit the stove on a night shift it became so hot that it set fire to some adjacent timbers, then the core shop, and finally the core shop was burned down. Mr. Fleming concluded by thanking Mr. Yeoman and the social committee for organising the function.

MR. C. VAN DER BEN, senior branch vice-president, then proposed the toast of the visitors, to which DR. C. J. DADSWELL replied.

The toast of "The Ladies" was given by MR. TOM MAKEMSON, M.B.E., and replied to by MRS. D. FLEMING, who was the recipient of a table lamp as a memento of the occasion.

Mr. Yeoman was cordially thanked for his duties as organiser by Mr. E. Longden. The function concluded with dancing, Mr. F. A. Harper being the M.C.

Marine Engineers' New Secretary

The Institute of Marine Engineers' secretary as from October next will be J. Stuart Robinson, who will take over the duties upon the retirement of B. C. CURLING. Mr. Curling, whose impending retirement was announced some time previous, joined the institute as assistant secretary 30 years ago. He has been secretary since 1930.

Mr. Robinson has been Mr. Curling's assistant for the past three years. He holds an M.A. degree and during the war served with the Royal Air Force. Before joining the Institute of Marine Engineers, Mr. Robinson was a member of the editorial staff of the Institution of Mechanical Engineers.

Tribute to Mr. Curling's "great work" as secretary of the institute was paid by Sir Gilmour Jenkins, permanent secretary to the Ministry of Transport, when he proposed the toast of "The Institute" at the recent annual dinner.

Annual Conference Programme

(*Continued from adjoining page.*)

SESSION D (at the Neville Hall, Newcastle-upon-Tyne): No. 1004, "The Casting Characteristics of some Aluminium Alloys" (B.N.F.M.R.A.), by D. C. G. Lees; No. 1005, "D.T.D. 424—the Versatile Alloy," by A. P. Fenn (Aluminium Development Association); No. 1006, "Aluminium Casting Alloys—Survey of their Properties and Methods of Production," by F. H. Smith (Associate Member).

2.30 p.m. to 4.30 p.m. Two simultaneous sessions.

SESSION E (at the Literary and Philosophical Society, Newcastle-upon-Tyne): No. 1007, "Reduction of Dust in Steelfoundry Operations," by W. A. Bloor (B.I.S.R.A.); No. 1008, "Observation and Control of Dust in Foundry Dressing Operations," by R. F. Ottignon and W. B. Lawrie, M.SC., F.R.M.S., A.I.M. (Member), followed by a film entitled "Dust Flow" (B.S.F.A.); No. 1009, "Survey of the Method and Principles involved in the Mechanical Charging of Cupolas" (B.C.I.R.A.), by W. J. Driscoll, B.SC. (Member).

SESSION F (at the Neville Hall, Newcastle-upon-Tyne): No. 1010, "Report and Recommendations of Sub-committee T.S. 20—Soundness of Iron Castings"; No. 1011, "Steel Foundry Radiographic Practice," by G. M. Michie, M.A., A.INST.P., A.I.M. (B.S.F.A.); No. 1012, Report and Recommendations of Sub-committee T.S. 31—Heat-treatment of Grey Cast Iron.

Royal Society of Arts Competition

THE Royal Society of Arts last year organised a series of competitions amongst which was "An original design for any heating appliance, designed to burn solid-fuel, for use in the home, or in individual rooms or offices, shops, restaurants, schools, or smaller public buildings; but excluding industrial, central-heating, and engineering installations. Candidates were asked to submit a perspective drawing of the appliance showing the over-all appearance and indicating the preferred colour scheme, and one or more scheme drawings showing or specifying the general arrangement, construction, materials, treatment and finish." The set time allowed was 30 hours in three weeks.

After having carefully considered the entries submitted, the Jury came to the conclusion that the work of Mr. Ronald David Carter (Fig. 1) (L.C.C. Central School of Arts and Crafts: age 22) and that of Mr. Michael Fitzpatrick (Fig. 2) (a draughtsman in the drawing-office of Radiation Group Sales, Limited, Aston, Birmingham; age 26), both of whom had been commended in the 1949 Competition, were of equal merit. Their work this year showed in each case much improvement and both deserved the benefits of a full Bursary. The Jury recommended, therefore, that an additional grant be made to enable two full Bursaries to be awarded this year in this Section.

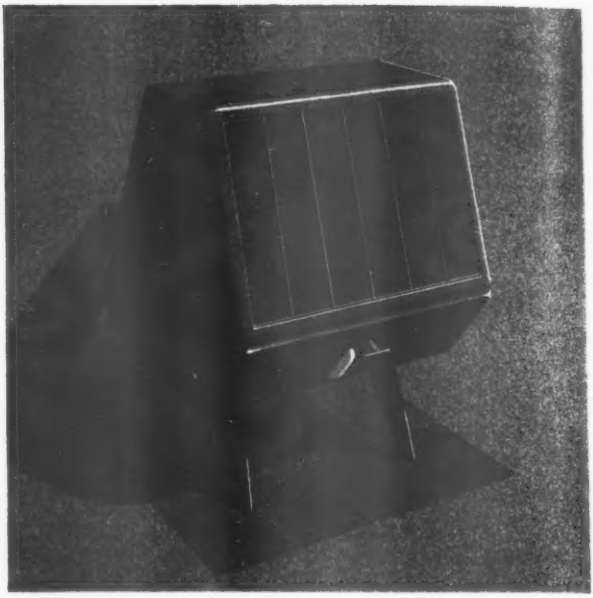

FIG. 1 (*Above*).—*Design for a free-standing solid-fuel-burning stove, by Mr. R. D. Carter.*

Mr. Carter had clearly considered the problems presented to a designer of solid-fuel appliances and, although requiring more practical training, which a course of technical instruction would supply, he showed in his examples of work and in his design for the set test of a free-standing stove that he had thought carefully over his designs and had many good ideas and much promise.

Mr. Fitzpatrick, whose presentation had improved considerably since last year, had tried to do something different in the way of stove design; and although his perspective drawing was a little exaggerated and not as satisfactory therefore as his detailed drawings, he had succeeded in producing a design which was technically good. His commendable attempt to break away from orthodoxy in design deserved the fullest encouragement.

The Jury also commended the work of Mr. Colin Tonks (a draughtsman with Radiation Group Sales, Limited, Aston,

(*Concluded on page* 318)

FIG. 2 (*Left*).—*Design for a slow combustion solid-fuel-burning stove, by Mr. Michael Fitzpatrick.*

Fundamental Production Planning in the Foundry*

By P. Rohrhirsch
[SLIGHTLY ABRIDGED]

A production increase in any industrial activity depends upon the willing co-operation of the entire labour force and on the personality of those in charge of production planning and layout. Small-scale individual experiments and ill-organised "tinkering" are usually doomed to failure, since they are liable to shatter the mutual confidence between employee and management, but success may be achieved if a clear picture of the ends in view and the means to be employed is available to all.

The necessity for increased productivity as a means of increasing the social wealth of a community is not always universally understood. Only when the notion of a common purpose designed for the common good has been generally accepted can a business set about making an all-round production increase. The plan in view must be clearly set out, plain questions must be asked and plain answers given. Half-measures will never get the desired results and sooner or later are condemned to failure. Each separate item of works' reorganisation must be integrated with the basic plan if successful results are to be ensured. If there is no basic plan, then the attempt to increase production is liable to degenerate into a series of dangerous individual experiments, with no guarantee of concrete improvement in the whole operation.

Long-term Objects

The purpose of a production increase is not the raising of the output over a short period only, but an overall and lasting increase in output without any falling-off in the standard of workmanship. It is thus extremely important to understand fully the nature of the demands to be made. For example, fatigue can lead not only to a failure to maintain output, but also to lack of attention and concentration, which in turn increases the liability to accident. By means of mechanisation the bodily effort required can be reduced to a minimum, but because of this the work-tempo cannot be increased without careful consideration, since this may lead to excessive fatigue and thus to greatly enhanced demands on the worker. A worker's load cannot be safely increased beyond the point at which he is ready and willing to accept it. In order to make this load-setting and acceptance as high as possible, the arrangement of working spaces and working places must be most carefully considered in regard to their suitability to the physical make-up of the man. All these external influences are intimately bound up with the questions of the maximum work-load. When one set of circumstances is altered, it is necessary to examine very carefully the effect of this alteration on the total environment. The essential nature of production planning may thus be stated as follows:—

"Fundamental production planning is the consideration of the simplification of working conditions in order to lighten as far as possible the physical effort of the men engaged."

The purpose of all production planning is to make the workmen free of all unnecessary effort in order to concentrate entirely upon useful operations and so raise the acceptable output level of men and machines to the highest possible point. For this purpose it is necessary to undertake an examination of all the conditions influencing men, materials, machines, etc., to work out means whereby these may be utilised to the best possible advantage, and in addition take into account all the relevant factors regarding wages and costs, and so build up a comprehensive picture of the real nature of any industrial operation. A short-term time-and-motion study is quite unsuited to this type of investigation. Such a study tends by its very nature to act as an interference in normal production routine and thus, whatever results be recorded, they may represent a displacement from the real "norm." Only an investigation stretching over weeks and even months can give results which can be safely regarded as not subject to external upsetting influences.

Study of the Working Place

One of the most important features of the investigation of this nature is the study of working place. In this connection, the most important aspects, with particular reference to the foundry industry, are:—

Material Storage.—Meaning the placing of necessary working materials, such as moulding sand in hoppers, skips or wagons.

Auxiliary Items and their Positioning.—In this category come, for example, such things as rammers, reinforcing rods, air-lines, coreplates, mould plates, moulding boxes, core-boxes, chills, etc.

Finished Work Storage.—This covers the disposal of finished items, such as cores, moulds, etc., or the arrangements for holding the cores prior to setting and moulds prior to pairing.

Waste Material Disposal.—That is, how to deal with items such as moulding sand and core sand which in course of use spills on to the floor.

Work Height.—Consideration of such matters as the level of work benches and machines, and also the amount of ceiling space available in order to avoid any cramping of operations.

Natural and Artificial Lighting.—Daylight should be sufficient for the work in hand and be so arranged that the worker is not dazzled. Artificial light must satisfy the conditions of suitability, cost and workers' health. Light and lighting are not the same thing; it is possible to have more than sufficient light available, but so arranged as to be quite unsuitable for the work involved. Good lighting is marked by

* Presented at the R.E.F.A. Foundrymen's Conference at Hanover, June, 1950, and translated from *Die Neue Giesserei.*

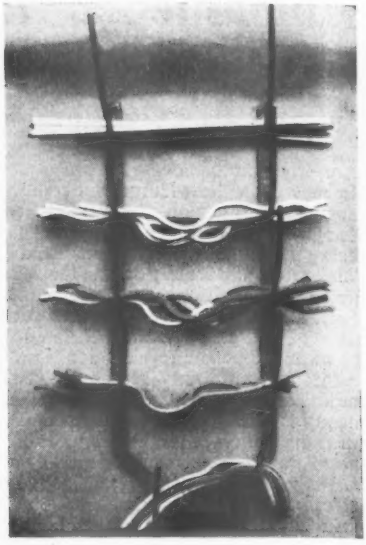

FIG. 1 (*Top Left*).—*Original Layout of a Roll-over Machine; the Arrows show the Positions of the Moulder's Materials and Sundries.*

FIG. 2 (*Bottom Left*).—*Rearranged Set-up for Operating a Roll-over Machine.*

FIG. 3 (*Above*).—*Gadget for carrying Reinforcing Irons at a Moulder's Station.*

sufficient intensity, freedom from dazzle, uniformity, freedom from flicker and a proper distribution of light and shade.

Working Hazards.—In this category are considered all outside influences which may affect the workers' health such as heat, steam, damp, cold, dirt, dust, acid, noise, etc.

Working Protection.—This includes measures to protect the workers' health against the various hazards enumerated above.

Clothing.—Under this heading comes the supply of suitable protective garments for certain forms of work which might otherwise be dangerous, *e.g.*, shot-blasting.

Arrangement of Personal Items.—Meaning the hygienic disposal of such personal effects as packed meals, drinking mug, etc.

Tidiness and Cleanliness.—The orderliness of the individual working place is primarily the worker's own responsibility. The tidiness of the whole shop, however, is important—particularly the maintenance of free passageways for all forms of transport.

Method of Investigation

In cases where one can consider a large number of similar operations, a direct comparison can be made between well-laid-out and badly-laid-out working places. Where, however, the operations are all different, the essential nature of what constitutes an efficiently-arranged working place must first be elucidated. Only when this basic knowledge has been gained may any indirect comparisons be made.

Foundries are a typical example of the latter case, in which there are a large number of different operations, each requiring a working place suited to individual needs. In general, these operations may be enumerated as follow:—Machine moulding; core-making; hand moulding; mould setting; casting; shake-out; melting; sand preparation; and dressing.

The basic planning of each of these separate operations makes up the sum of production planning throughout the foundry. Without any major increase in costs, the overall production can by this means be raised to the highest level. The following two examples of organic planning are cited—in machine moulding and in core-making.

FIG. 4 (*Above*).—*Rack Arrangement for carrying Moulder's Tools.*

FIG. 5 (*Top Right*).—*Original Arrangement of Bench for Hand Coremaking. Note the Disorderly Collection of Sundry Materials.*

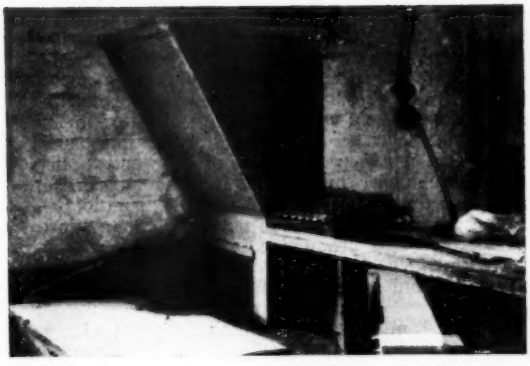

FIG. 6 (*Bottom Right*).—*Rearranged Coremaking Bench with Sand supplied from a Side Hopper.*

Material Storage

(*a*) In machine moulding (Figs. 1 to 4).

First Arrangement.—The moulding sand is transported in a skip by hand labour to the moulder and taken out of the skip by means of a shovel as required.

Reorganisation.—Sand transport and shovelling both eliminated by means of a mechanical sand chute arrangement.

(*b*) In coremaking (Figs. 5 and 6).

First Arrangement.—Core sand is brought in a skip to the working place and then shovelled on to a corner of the work bench. This method of material storage gives the bench a very untidy appearance.

Reorganisation.—An overhead sand hopper is employed, which may be kept charged by various means. It is also possible to use a single hopper to serve several work places by means of chutes if required.

Fig. 1 shows a working place around a roll-over moulding machine as it unfortunately all too often appears in foundry practice. The arrows indicate the places where improvement can be made in the arrangement of the sand skip and the odd items, such as chills and reinforcing bars, which have been thrown down in a heap. The workman's personal tools are lying on a board against the wall. With an arrangement such as this it may be noted that two men are required for the job.

Fig. 2 shows the same work place after reorganisation. Sand is no longer shovelled out of the skip, but passes through a bunker and chutes to the moulder. Sundries are now placed in a special holding device on the wall (Fig. 3) and the moulder's personal tools are now set in a readily available position close to the moulding table (Fig. 4). Plates for use with the chills are stacked one on top of another near at hand. Thus, all physical effort may be concentrated upon the work in hand and all other motions are cut down to a minimum, since everything is located about the working place in an orderly fashion.

Foundry Production Planning

Conclusions

These examples indicate how, at a reasonably low cost, working places even in a very small foundry may be reorganised. However, before the results of such a departure can be profitably realised it is essential that all operations in the sequence be studied and improved upon. To achieve this a master plan is necessary wherein the working places are considered in groups, *i.e.*, moulding machines,* core-making, pouring, etc., and each group is subjected to study which is carefully recorded. Sketches of proposed improvements may be made and discussed, and throughout the period of reorganisation, which may take several months, photographs of the working places in different stages of improvement may be taken and will be found very useful. In this way, by means of slow and thorough investigation the efficiency of each individual process in the sequence may be improved upon and integrated with the improvement in output of the foundry as a whole.

In all this work, however, it is essential that the main purpose of the reorganisation be not lost sight of, namely, that of enabling the foundry to achieve a higher rate of output without increasing the individual work-load carried by each operator to an intolerable level. Fundamental production planning is the first step of a series of ways and means to achieve higher output, but it is not concerned only with the technicalities of machine operation; it is concerned with the cost in terms of human effort of an increased production. The work may be considered as coming under three headings—men, machines, and materials—all of which are equally important.

Finally, it must be reiterated that without willing and ready co-operation between the management and the whole staff nothing can be achieved. There must be an equally strong desire to increase productivity on the part of all and any tension will at once destroy all that has been gained. Above everything, this fundamental tenet of works' management must be constantly borne in mind—a man is not merely a machine; he possesses a soul.*

* Translator's note.—Persons interested in management/worker relations as touched upon here are strongly advised to read "Are Workers Human?" by Gordon Rattray Taylor.

IT HAS BEEN ANNOUNCED by the Sheepbridge Company, Limited, Chesterfield, that Mr. E. Marvill has been appointed general manager to the Company. Mr. Marvill, who is a native of Rotherham, joined the Sheepbridge Company, Limited, as chief engineer on February 1, 1950. He was previously connected with the Nuffield Organisation, and prior to this was on the staff of the Park Gate Iron & Steel Company, Limited, Rotherham. During the past year Mr. Marvill has been in control of all installation work carried out in connection with the new blast-furnace reconstruction scheme. The scheme embraces a new furnace which will shortly be put into commission, together with sintering, crushing and ore-drying plant. A second furnace will be added later and when completed the plant will be one of the most modern in the country engaged in the production of foundry pig-iron.

R.S.A. Address by Lord McGowan

If we accept an increase in overall national productivity of not less than 5 per cent. per annum as our objective, then a similar rate of increase is required in the supply of graduates and others with the necessary applied scientific training," said LORD MCGOWAN, K.B.E., Honorary President of Imperial Chemical Industries Limited, in the course of the Trueman Wood Lecture on "A Century of British Industry," at the Royal Society of Arts recently.

That proposal involved a radical shift in the balance of our educational system. It meant, for example, that technical colleges would have to be upgraded to share the burden with the universities. But if it was achieved, and the larger number of trained men and women were forthcoming, we should still have to see that they were absorbed into industry and employed to the best purpose. It was true that many, but not all, companies in this country fully appreciated the need to strive continuously after greater technical proficiency in production. If our educational system put greater emphasis on the practical application of science, that would help to mould the outlook of management along the desired lines.

In the meantime, we should have to make a strong and well-reasoned appeal to management to absorb new men into industry to regain initiative in setting up new methods and new lines of production. Only in that way could we hope to keep ahead of the younger industrial nations and have new products to offer in place of those which tended to decline in importance in international trade.

One purpose of examining the history of what had happened in the past was to try to draw from it guidance for the future. He suggested, therefore, that serious consideration be given to the steps required to ensure, as a matter of national policy, the practical application of scientific knowledge.

Royal Society of Arts Competition

(*Continued from page* 314)

Birmingham, and also a student at the College of Art, Birmingham: age 25), who was awarded a Bursary in the 1948 Competition, and they were pleased to note the improvement in his work and in its presentation which was now excellent. The work of Mr. Dennis Geoffrey Gale (L.C.C. Central School of Arts and Crafts: age 20), which had been commended in the 1947 Competition and had improved considerably since, again attracted the attention of the Jury. They recommended that he should be given an opportunity of visiting a foundry to improve his knowledge of the technical side of the industry. The designs submitted by Mr. William Edward Allen (an apprentice with Radiation Group Sales, Limited, Aston, Birmingham: age 19), showed promise and originality of thought, and the Jury looked forward to seeing his work again next year.

The Jury were disappointed at the apparent lack of design sense in this year's entries, but were impressed by the continued improvement of presentation, on which they had commented in their 1949 Report.

Cast Milling Cutters

New Production Technique

With regard to materials for cutting tools, it would appear that the limits of efficiency have been reached with the conventional tungsten and molybdenum high-speed steels. The application of surface treatments is, however, a step in the right direction for greater tool efficiency. Another way of improving overall machining efficiency is to reduce the cost of tools. This can be done in several ways, but one that is of special interest is the use of milling cutters produced by a casting process.

B.S.A. Tools, Limited, have approached this problem from the point of view of toolmakers rather than foundrymen. Consequently the accent is on cutter design and material, and full advantage may be taken of the fact that cutters of excellent design from a cutting point of view, *e.g.*, staggered tooth side and face types, can be produced as easily as cutters of inferior design such as straight tooth side and face cutters.

The material used is based on a 1.3 per cent. C, 13 per cent. Cr alloy containing small amounts of tungsten and vanadium. This steel possesses good casting properties with freedom from massive segregation in the cutting teeth. Figs. 1 and 2 show good and bad microstructures respectively from the teeth of similar side and face cutters. It will be noted that the spheroidised structure shown in Fig. 1 is similar to that shown by a normal hot-worked 18/4/1 high-speed steel and no traces of any cast structures are apparent. These cutters are capable of removing stock at a rate of at least as great as that of a standard cutter made from 18/4/1 high-speed steel. It is, however, essential that a copious supply of "soluble" type cutting fluid is used.

The nature of the pattern, mould composition, composition of the tool steel and method of pouring are carefully controlled and differ greatly from normal foundry procedure. The design of the pattern, and particularly the mould, is important and needs care and attention to a number of details to achieve a sound casting, but with this attention there is virtually no tool shape which cannot be produced by this process. Fig. 3 illustrates a group of various cast cutters.

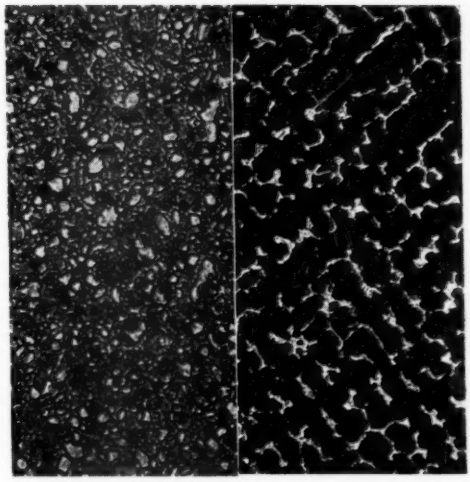

FIG. 1 (*Left*).—*Good Microstructure of Cast Milling Cutter.*
FIG. 2 (*Right*).—*Unsatisfactory Structure of Cast Milling Cutter.*

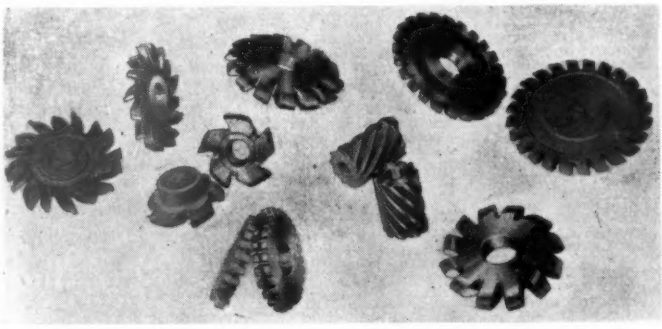

FIG. 3.—*Group of Finished Cast Cutters and Original Castings.*

Advantages of the Process

The casting technique possesses several advantages:—(1) The tool designer may design tools of maximum efficiency without the limitation effected by conventional methods of machining from the solid; (2) it is possible to produce milling cutters with alternate teeth having opposite helix angles with no more difficulty than a cutter with identical teeth; (3) cutting teeth can be produced having any shape in any direction; (4) cutters can be produced having ample swarf clearance and are still efficient after a number of regrinds; (5) where a cutter has a constant axial shape and plain ends—as, for example, a helical slab mill with plain ends—it is possible to produce cutters of any length (within the limits of the pattern) from one standard pattern. A pattern for a 6-in. long cutter would produce tools any length from $\frac{1}{2}$ in. up to 6 in. long; (6) where form-relieved cutters are made, it is possible to take advantage of the special surface treatments. As the rake faces only are ground, such treatments will help to prevent wear on the clearance faces.

The range of the process is not limited to the production of milling cutters. Other items which have been produced include blanks for manufacture into thread rolls, special turning tools, inserts for broaches, and extrusion-die blanks.

Personal

L. B. PFEIL, O.B.E., D.SC., A.R.S.M., director of the Mond Nickel Company, Limited, and head of the Company's research and development department has been elected a member of the Royal Society.

MR. D. J. CHILTON, British Iron and Steel Research Association bursar in Dr. U. R. Evans's corrosion laboratory at Cambridge University, has been elected captain of the university's lacrosse team.

MR. P. J. C. BOVILL, B.SC., director of the local board and general manager of the chemical works of Newton Chambers & Company, Limited, has been appointed chairman of the Sheffield No. 1 Hospital Management Committee.

MR. M. STEWART FRASER, proprietor of Andrew McLean & Company, ironmongers' and engineers' furnishers, of Glasgow, has been elected president of the Iron, Steel and Ironmongery Benevolent Association of Scotland.

MR. G. KELWAY has been appointed area manager in Birmingham of A. C. Wickman, Limited, in succession to Mr. C. R. Perks, who is leaving England shortly to establish and manage a new branch factory at Mentone, Melbourne, Australia.

MR. ALBERT B. SMITH, recently with the A.P.V. Company, Limited, aluminium founders, chemical engineers, etc., of London, S.W.18, has been appointed manager of the Derby office of James W. Ellis & Company, Limited, constructional and industrial engineers, of Newcastle-upon-Tyne.

Increases of Capital

The following companies are among those which have recently announced details of capital increases:—

CONDOR IRONWORKS, LIMITED, Oldham, increased by £5,000, in £1 ordinary shares, beyond the registered capital of £5,000.

GOLDENHILL FOUNDRY, LIMITED, Newcastle (Staffs), increased by £2,000, in £1 ordinary shares, beyond the registered capital of £1,000.

PENNEY & PORTER, LIMITED, general engineers, etc., of Lincoln, increased by £10,000, in £1 shares, beyond the registered capital of £25,000.

WOMBWELL FOUNDRY & ENGINEERING COMPANY, LIMITED, near Barnsley, increased by £50,000, in 2s. ordinary shares, beyond the registered capital of £100,000.

C. HORNE & COMPANY, LIMITED, electrical, mechanical and general engineers, etc., of Middlesbrough, increased by £3,000, in £1 shares, beyond the registered capital of £2,000.

CARMICHAEL BROS., LIMITED, ironfounders, shiprepairers, etc., of South Shields, increased by £20,000, in £1 ordinary shares, beyond the registered capital of £10,000.

WORTHINGTON-SIMPSON, LIMITED, pump manufacturers, etc., of Newark-on-Trent, increased by £525,000, in 10s. ordinary shares, beyond the registered capital of £475,000.

P. L. WILLCOX, LIMITED, brassfounders, etc., of Birmingham, increased by £10,000, in 9,620 ordinary and 380 unclassified shares of £1 each beyond the registered capital of £5,000.

SAMUEL BUTLER & COMPANY, LIMITED, engineers, steel and iron founders, etc., of Stanningley, Leeds, increased by £50,000, in £1 ordinary shares, beyond the registered capital of £25,000.

FEATHERSTONE AGRICULTURAL, LIMITED, mechanical agricultural implement manufacturers, etc., of Edgware, increased by £7,000, in £1 shares, beyond the registered capital of £1,000.

BASSETT SMITH & COMPANY, LIMITED, metal merchants, etc., of London, E.C.2, increased by £100,000, in 10,000 5 per cent. non-cumulative preference shares of £1 each, and 360,000 ordinary shares of 5s. each, beyond the registered capital of £50,000.

GWB ELECTRIC FURNACES, LIMITED, Watford, increased by £15,000, in £1 ordinary shares, beyond the registered capital of £10,000. At July 7, 1949, 5,000 shares of £1 had been issued, of which Gibbons Bros., Limited, held 2,497 shares and Wild-Barfield Electric Furnaces, Limited, 2,498 shares.

Obituary

MR. H. A. HUMPHREY

Inventor of the gas pump known by his name and a distinguished chemical engineer, Mr. Herbert Alfred Humphrey died in South Africa last Friday at the age of 82. He was born in London and was trained at Finsbury Technical College and the City and Guilds Institute, South Kensington. In 1900, when he was appointed engineer and departmental manager at the Winnington works of Brunner, Mond & Company, Limited, began an association with that company and its successors and subsidiaries which was maintained throughout his active life. One of his most notable achievements, the invention of the Humphrey gas pump, came a few years later. The pump was shown at the International Exhibitions at Paris (1908), Brussels (1910), and Turin (1911), in each case winning the highest award. In 1913 a large installation of the pumps, capable of pumping over 200,000,000 gallons of water a day, was completed at Chingford reservoir.

MR. J. GILL, works manager of the Tees Side Bridge & Engineering Works, Limited, Middlesbrough, died suddenly at Redcar at the age of 47.

MR. GEORGE GLENN, chief metallurgist and chemist of Tinsley Wire Industries, Limited, Sheffield, has died. He was a founder member of the Sheffield Metallurgical Association, and became its president in 1942.

MR. DAVID BROWNLIE, well known over a long period of years as a fuel technologist and consultant, died recently at the age of 71. He was the author of numerous Papers on fuel, chemical, and metallurgical subjects. Born in Manchester, he secured his B.Sc., with honours in chemistry, at London University. He served for some time as a technical chemist and chemical engineer in the aniline dye industry, but later specialised on fuel economy. He was the author of over 20 original Papers on steam generation, giving detailed results of performance of 400 different boiler plants in Great Britain, and he devised a new international boiler-test code. He was a Fellow of the Chemical Society, a member of the Society of Chemical Industry and of the Institution of Chemical Engineers, and an associate member of the Institution of Mining Engineers.

Wills

OSBORNE, ROBERT, late managing director of the Le Bas Tube Company Limited, London, E.C.2 ... £20,282

SMEDLEY, A. B., director and secretary of Smedley Bros., Limited, engineers and ironfounders, of Belper £14,029

GREAVES, S. H. L., a director of Textile Machinery Makers, Limited, and of Platt Bros. & Company, Limited, Oldham, and formerly chairman of Dobson & Barlow, Limited £3,958

FORSTER, J. H. B., chairman of South Durham Steel & Iron Company, Limited, and Cargo Fleet Iron Company, Limited, late managing director of the Weardale Steel, Coal & Coke Company, Limited, a member of the River Wear Commissioners, and associated with many other companies £396,340

MATTHEWS, MAJOR D. S., chairman of Turton Bros. & Matthews, Limited, manufacturers of alloy steels, tools, and springs, of Sheffield, and a director of J. P. Skinner & Company, Limited, spiral spring manufacturers, of Sheffield, the Clydesdale Stamping Company, Limited, Netherton, Dudley, and Redfern & Stevens, Limited, machinists, of Birmingham £68,465

SHIPHAM & COMPANY, LIMITED, propose extending their brass foundry at Hawthorn Avenue, Hull.

European Steel Production

Expectation of 75,000,000 *tons in* 1953

New data on European steel production, bringing its previous report up to date, have been published by the Economic Commission for Europe. The original study, published at the end of 1949, aimed at providing a clear picture of the future problems of the iron and steel industry, and at laying down certain broad lines for possible future co-operative action in Europe likely to meet the problems. The revision just published ("European Steel Trends in the Setting of the World Market," Stationery Office, 11s.) supplies new estimates of trends in steel production, consumption, and trade in Europe and other parts of the world.

On the basis of present plans, Europe (not counting Soviet Union) expects by 1953 to have a capacity to produce the equivalent of nearly 75,000,000 tons of crude steel. Actual production during 1950 was 60,700,000 tons. The new calculations are based on the same fundamental assumptions as the original study. These assumptions include 100 per cent. fulfilment of production plans, and on the consumption side they exclude the effects of enlarged defence programmes.

It is pointed out that, while the impact of the new defence programmes is already being felt, probably so far through orders for stocking-up more than in direct defence production, it is impossible to foresee how long the present pressure on steel supplies will last. The E.C.E. secretariat states: "Armament programmes cannot be regarded as a permanent outlet for the steel capacity which on present plans will be available. When the defence programmes are finished, alternative requirements for normal purposes will not necessarily have developed to take their place. It would be a mistake, therefore," the report continues, "to assume that a continued high demand would justify a disregard of measures to promote efficiency and lower costs in the European steel industry. The only satisfactory permanent basis for expanding the demand for steel must be through extension of its use by promotion of both quality and cheapness."

Increased Industrial Activity

Thus, although present increased industrial activity resulting from the international situation provides a sharp contrast to the difficulties which the original study stressed as facing the European economy at the end of 1949 (the slowing down of the rate of investment, the increase in unemployment, and the many obstacles to international trade, all of which made it doubtful whether steel production plans could be implemented), the measures advocated in the previous survey must still be regarded as valid, the secretariat states.

The first of the four measures proposed is the reduction of European steel costs by the rationalisation of production (*i.e.*, concentration on a smaller range of products and size, and production in economic locations), the ensuring of adequate supplies of good-quality and cheap raw materials for steelmaking, and a wide exchange of information on improvements in steel-producing techniques. The remaining three measures are the promotion of knowledge of steel uses and the development of new uses for steel; the maximum possible freedom of trade in steel, and a degree of restraint on steel prices as would permit the benefits of low-cost production to be fully realised.

New plans aim at the establishment of 63,200,000 tons of steel production capacity in western Europe in 1953. This is 3,400,000 tons above the 1953 capacity which western European countries foresaw in 1949. (In the absence of information to the contrary, a rate of 13,500,000 tons is included for western Germany.) Eastern Europe steel production capacity plans (not counting those of the Soviet Union) have been raised by 1,000,000 tons for a 1953 total of 11,500,000 tons. The study indicates that the European planned total of nearly 75,000,000 tons of crude steel capacity in 1953 will be reached, and that production itself might attain that level—provided adequate supplies of raw materials are available and the demand for that quantity of steel exists.

The revision brings up to date the original study's statistics on steel production, consumption, and trade in Europe and other regions of the world, and modifies forward estimates on the basis of new information. New estimates put European steel demand in 1953 at 60,000,000 tons in terms of crude steel. This level would represent an increase of 9,000,000 tons over consumption in 1949. The report stresses that this estimate is likely to be on the "small side," since it does not take into account the effects of the new defence programmes in process of formulation in most countries.

Net imports of steel into Africa, the Middle East, the Far East, and Latin America in 1953 are expected to be affected by production in those areas, which may rise faster than consumption, so that imports are likely to decline from 1950-51 levels. Thus, it is estimated that in 1953 net imports of European steel by underdeveloped areas might not exceed the 1949 level of 7,300,000 tons. The report points out that, while there is again quite a good market in the United States for European steel, "this may only be of a temporary character, dependent on the demand generated by the defence programme and liable to fall off as additional production capacity is brought into operation in the United States." The trend towards increased Canadian imports of European steel is expected to "continue for some time at least."

Record February for Steel

At an annual rate of 16,952,000 tons, steel output in February was at the highest rate ever achieved in the month of February. In February, 1950, output was at an annual rate of 16,898,000 tons.

Last month's pig-iron output was at the rate of 9,687,000 tons, compared with 9,588,000 tons a year ago.

Latest steel and pig-iron output figures (in tons) compare as follow with earlier returns:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1951—January ..	183,100	9,520,000	305,900	15,907,000
February	186,300	9,687,000	326,000	16,952,000
1950—January ..	187,400	9,742,000	305,300	15,873,000
February	184,400	9,588,000	325,000	16,898,000

G.K.B. Valuation

The board of Guest, Keen & Nettlefolds, Limited, announces that the stockholders' representative has agreed with the Minister of Supply the settlement of compensation value under the Iron and Steel Act, 1949, of the £1 ordinary shares of Guest Keen Baldwins Iron & Steel Company, Limited, at 55s. per share.

The issued ordinary capital of Guest Keen Baldwins totals £3,675,004, of which £2,100,002 is held by Guest, Keen & Nettlefolds.

Training of Supervisors

Nearly two years have elapsed since the first meeting of experts from European countries on the training of supervisors was held in Geneva. Twelve countries were represented and three reports prepared by the International Labour Office were examined, the conclusions reached being embodied in a report to the governing body of the ILO.

The second meeting, also held at Geneva, concluded last Saturday and has been considering the following agenda:—Problems of the development of integrated programmes for the training of supervisors in particular countries and the introduction of new systems into particular countries; use of systems of training of supervisors both in industry and in other fields of activity; the execution of programmes for the training of supervisors, including the use of manuals, etc., from other countries, the development of the training of supervisors inside particular establishments, and the use of audio-visual aids; special problems of the use of the Training Within Industry system, both alone and in combination with other systems; and development of further international co-operation in the training of supervisors.

The United Kingdom delegation at the meeting comprised:—Mr. W. L. Buxton, under secretary, Ministry of Labour and National Service; Mr. A. J. Nicol, personnel director of Joseph Lucas (Electrical), Limited, and group personnel manager of Joseph Lucas, Limited, and Mr. H. G. Knight, general secretary of the Association of Supervisory Staffs, Executives and Technicians. Mr. Buxton was accompanied by Mr. E. Lord, senior trainer of the Ministry of Labour.

Indian Iron and Steel Industry

Total capital investment of the main iron and steel producers in India is £51,100,000. Skilled and semi-skilled workers employed in the industry number 58,000. The installed capacity of the main producers is estimated at 1,071,000 tons of finished steel and 1,878,000 tons of pig-iron. The actual production of pig-iron in 1949 was 1,579,000 tons, and of finished steel 927,000 tons. Maximum production of steel was attained in 1943, when output was 1,149,308 tons.

These figures were given at a meeting in New Delhi at which the iron and steel development programme was discussed by the Planning Commission with representatives of the manufacturers and Government departments.

Supplies of pig-iron for the foundries and of billets for secondary producers and re-rolling mills were examined. It was stated that foundry pig-iron requirements were of the order of 300,000 tons per annum, while secondary producers and re-rolling mills, which numbered about 90, required about 600,000 tons of steel a year, whereas they were at present obtaining barely 200,000 tons. It was suggested that new Government plant should concentrate on the production of billets in order to supply the requirements of re-rolling mills.

Finished steel demand during the next three years was estimated at 2,000,000 tons per annum, with the long-term target 2,500,000 to 3,000,000 tons.

OSBORN FOUNDRY & ENGINEERING COMPANY, LIMITED, of Sheffield, have now put into operation a new foundry for the manufacture of colliery-tub wheels. These are steel castings and the production rate is of the order of two per minute. The equipment used is entirely British machinery. So impressed were American visitors with British machinery that they have placed orders for plant of similar type in this country. The new shop is 150 ft. by 50 ft. wide and the sand handling has been completely mechanised.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference B.P.D. or C.R.E. can be obtained from the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, London, S.W.1.

CHIPPENHAM, April 18—Provision and laying of approx. 1,150 yds. of 4-in. and 6-in. dia. spun-iron water mains, etc., for the Borough Council. The Borough Engineer, 10, Market Place, Chippenham. (Deposit, £1 1s.)

GLANFORD BRIGG—Supplying and laying about 23 miles of 3-in. dia. spun-iron mains, for the Rural District Council. Mr. J. H. Haiste, chartered civil engineer, 4, Queen Square, Woodhouse Lane, Leeds, 2. (Deposit, £3 3s.)

JOHANNESBURG, April 5—Electric arc-welding sets, for the South African Railways. Room 1084 (CRE (IB) 55866/51).

MAESTEG, March 31—Iron castings, for the Urban District Council. Mr. E. Davies, engineer and surveyor, Council Offices, Maesteg.

NAIROBI, March 31—Water pipes, valves, filtration plant, etc., for the Municipal Board of Nakuru. The Town Clerk, Nakuru. (Deposit, £3 3s.)

NOTTINGHAM, March 29—Provision and laying of approx. 3,700 yds. of cast-iron pipes and fittings, for the City Council. Mr. R. M. Finch, city engineer and surveyor, The Guildhall, Nottingham. (Deposit, £2.)

Galvanised and Tinned Hollow-ware

The Board of Trade, in consultation with the Central Price Regulation Committee, has made the General Hollow-ware (Maximum Prices) (Amendment No. 3) Order, 1951, which amends the 1949 Order and permits manufacturers of galvanised and tinned hollow-ware to increase their prices, with effect from Monday next by a further 2½ per cent. and 19½ per cent., respectively, over the basic period prices.

These increases, which have been allowed by the board after a careful review, are due to the increased cost of zinc and raw tin, and will raise the permitted prices for galvanised and tinned hollow-ware to a total of 13½ per cent. and 22½ per cent., respectively, over the basic period prices. The basic period for the purpose of this Order is the two months ending July, 1949.

Home Production of Tungsten Ore

Production in this country of tungsten ore is to be restarted as soon as possible. Announcing this in the House of Commons, Mr. J. Freeman, Parliamentary Secretary to the Ministry of Supply, said that tungsten ore was at present mainly imported on private account, and importers were primarily responsible for securing adequate supplies.

Mr. Freeman said that the Ministry of Supply pressed for the highest possible quotas in trade agreements with producing countries and was itself negotiating long-term contracts for new or increased production from mines oversea

Fall from a Gangway

Damages totalling £1,250 were awarded to Percy Donnelly, a gasman, by a jury sitting with Lord Strachan in the Court of Session last Friday, against his employers, Colvilles, Limited, Dalzell Steel Works, Motherwell, for injuries sustained in an accident.

The pursuer claimed that his feet slipped on the metal surface of a gangway and that he fell 20 ft. over the unrailed side, receiving injuries which resulted in his being off work for seven months. His employers, he averred, had failed to provide safe premises for their employees to work in. Denying liability, the defenders maintained that the accident was solely caused by the pursuer's own negligence.

Stanton Machine-cast Pig Irons are clean-melting, and economical in cupola fuel.

All types of castings are covered by the Stanton brands of pig iron, including gas and electric fires, stoves, radiators, baths, pipes, and enamelled products generally; repetition castings requiring a free-running iron, builders' hardware and other thin castings.

Other grades of Stanton Foundry Pig Iron possess the necessary physical properties and strength ideal for the production of fly-wheels, textile machinery, etc.

Stanton Foundry Pig Iron in all grades is also available in sand cast form.

We welcome enquiries on foundry problems and offer free technical advice.

THE STANTON IRONWORKS COMPANY LIMITED - NEAR NOTTINGHAM

Rearmament Programme

Industrial Leaders' Appointments

At question time in the House of Commons, on Monday of last week, Mr. G. R. Strauss, Minister of Supply, announced that orders for machine tools for the defence programme had been placed on suppliers in the United States and in Western Europe for a value to date of approximately £40,000,000. These orders are part of a total of £115,000,000 of machine tools which the Chancellor of the Exchequer stated in his four-point plan for arms production to be necessary for re-tooling existing factory space and equipping new capacity. This total will include orders by private firms, placed according to their own estimated requirements.

On the same day the Minister of Supply also announced that Mr. S. W. Rawson, managing director of John Brown & Company, Limited, had been appointed director-general of machine tools. This appointment is one of three designed to strengthen the executive organisation of the Ministry of Supply in dealing with industrial problems arising from the rearmament programme. The other two men are Mr. G. Briggs, assistant managing director of Tube Investments, Limited, and Mr. W. C. Puckey, works manager of Hoover, Limited, who will be deputy controller of supplies (munitions) and deputy controller of supplies (air), respectively. All three appointments are unpaid.

Government's Measures

In order to increase the flow of machine tools for rearmament requirements, the Government is examining the order-books of 30 of the most important manufacturers to see how many machine tools can be diverted from non-essential purposes. The Government is also endeavouring to staff the undermanned machine-tool plants, and encouraging manufacturers to sub-contract their production.

This information was given by Mr. Strauss when he opened a debate on the Ministry of Supply estimates in the House of Commons on March 14. The Minister suggested that there might have to be some diversion of normal exports of tools to defence needs and that a new production programme, involving the taking over of existing factories and the building of new ones, might be necessary.

On the question of Government stockpiling, Mr. Strauss said: "We want to stockpile, but we are not going to divert metals from essential purposes in order to stockpile." Non-essential users, he said, might have their supplies cut in order to build up stockpiles.

The Minister announced that further large orders for machine tools were about to be placed with American industry. It was essential to the whole arms programme that these machines should come from the United States as quickly as possible. Discussions to that end were going on among executives at London and Washington. The total need of the defence programme Mr. Strauss put at 27,000 machine tools. On foreign orders, pre-payments amounting to £5,500,000 had been made in respect of some 9,000 tools, he said. These purchases from abroad would make no difference to the home industry or its future.

ANGLO METAL COMPANY, LIMITED—Mr. L. K. Brindley has been appointed to the board.

NEWTON, CHAMBERS & COMPANY, LIMITED—Lieut.-Col. H. W. Woodall has resigned from the board because of ill-health, and Mr. A. M. Holbein, a director of Demolition & Construction Company, Limited, has been appointed to the board.

News in Brief

THE ADDRESS of the *Association Technique de Fonderie de Belgique* has been changed to 21, rue de Drapiers, Brussels.

W. & T. AVERY, LIMITED, of Soho Foundry, Birmingham, inform us that they have now started the manufacture of Charpy impact testing machines.

WILLIAM ASQUITH, LIMITED—Mr. L. Rhodes has resigned the chairmanship but retains his seat on the board. Mr. R. W. Asquith has been appointed chairman and Mr. J. D. H. Horobin, secretary, has been appointed a director.

NET EARNINGS of the International Nickel Company of Canada, Limited, and subsidiaries for 1950 were $US48,765,849, compared with $US32,252,314 in 1949. After preferred dividends, earnings were equivalent to $3.21 ($2.08) per share on the common stock.

A NEW SHOWROOM has been opened by J. McGlashan & Company, brewery engineers and brassfounders, of Glasgow, which celebrated its centenary last year. The opening ceremony was performed by Mr. Hector McDonald, who has been with the firm for 52 years.

THE BETHLEHEM STEEL COMPANY is to build at its Nackawanna plant what is claimed to be the world's largest blast furnace. It will equal in size the new blast furnace recently built at the company's Sparrow's Point plant, which has a rated capacity of 514,000 short tons a year.

THE KAISER ALUMINIUM & CHEMICAL CORPORATION is to erect a new aluminium reduction plant at New Orleans. According to the "American Metal Market," the new plant will cost $79,000,000. The company is also to extend its Baton Rouge plant at a cost of $3,000,000, and is to develop its bauxite deposits in Jamaica at a cost of $7,500,000.

THE BOARD OF TRADE is to permit increases in maximum prices for all industrial overalls. The increases, which range from 5 to 21 per cent., have been requested by the clothing manufacturers and are due to the most recent rise in the price of cotton cloth. A number of new finishes which have recently been scheduled for overall cloths have been added for the appropriate garments.

Institute of Metals

The induction of the new president, Professor A. J. Murphy, Professor of Industrial Metallurgy, the University, Birmingham, formed the major item on the agenda of the first day of the annual general meeting of the Institute of Metals on March 13 at the Park Lane Hotel. In his presidential address, he spoke of the two-fold responsibility of service of the Institute: to the members and to the community. After describing briefly the admirable efforts of the Institute in performing the former task, he took the opportunity of suggesting that attention might be drawn to the industrial economics of metallurgy and that "the learned society could perform a valuable function by providing a forum where these aspects of metal economics might be discussed." Future readers of the Journal published by the Institute must be able to read the papers and discussions with some reference to the present-day metal shortages and economics; technical metallurgical factors are closely linked with economic considerations.

During the business meeting, Mr. Tasker, president during the past year, announced that the appeal to industry for financial support had been very gratifying, over 150 firms having promised to subscribe. Technical sessions included a one-day symposium held at the Park Lane Hotel on March 14, entitled "Metallurgical Aspects of the Cold-working of Non-ferrous Metals and Alloys."

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Raw Material Markets

Iron and Steel

No improvement can yet be recorded in regard to the supplies of raw materials for the blast furnaces; on the contrary, each week that passes seems to accentuate the difficulty of keeping the blast furnaces in full-scale operation. A fairly regular flow of hot metal to the melting shops is maintained, but foundrymen are receiving a good deal less than their required tonnages. They are still drawing liberally on their stocks, but this is a process which obviously cannot be continued indefinitely. All grades are scarce, and there is no prospect of early improvement.

The continuing dearth of Continental steel semis has imposed a heavy strain on the resources of the British steel industry. Most of the material supplied to the re-rolling industry is of British origin, and although defectives as well as primes command a ready sale, aggregate deliveries fall short of consumers' requirements. The position is under constant review, but the makers are adopting a cautious policy in regard to forward commitments. Every effort is being made to ensure that the sheet mills are employed to the limit of their capacity, but light section and bar mills are subject to hold-ups owing to occasional difficulties in the supply of billets.

Rearmament orders are not yet imposing very heavy claims upon the finishing mills, and now the voluntary export restrictions have been removed, rollers are devoting more attention to the fulfilment of oversea orders, of which there is a considerable accumulation. A good deal more business of this description is on offer, as British prices and delivery dates are attractive as compared with those of European producers. Here, as elsewhere, however, the demand exceeds a reduced output, and until the outlook clarifies makers are not keen to take on more business.

The maximum prices of certain types of bolts, nuts, studs, screws, and rivets were increased on Friday last under the Bolts, Nuts, etc., Prices Order, 1951 (SI No. 404), which consolidates previous Orders, and covers all items specified in those Orders with the exception of aircraft, bolts, nuts, and screws.

Non-ferrous Metals

The Minister of Supply has made a new Order to overcome certain anomalies in scrap metal trading and to remove difficulties which have prevented the free flow of non-ferrous scrap to industry during recent weeks. The Order—the Non-ferrous Metals Prices (No. 2) Order (SI 1951, No. 425)—came into operation on Saturday and makes the following alterations:—The maximum commission for merchants on material other than lead is increased from 2 per cent. to 3 per cent.; the maximum charge for bagging is increased from 9d. per bag to 1s. 6d. per bag, or 25s. per ton, whichever is less; a charge for briquetting not exceeding 25s. per ton is authorised; the basis of lead prices is changed from "delivered buyer's address" to "ex depot," with the proviso that when lead material is delivered by the seller the charges for delivery shall not exceed £2 per ton; provisions relating to invoices have been amplified; a number of definitions have been clarified, and price changes made.

The revised prices (per ton) are as follow:—

COPPER—Clean, bright, untinned wired or commutator bar, £190; clean, bright wire, tinned, £185; firebox cut to crucible size, £185; firebox not cut, £180.

LEAD—Remelted, containing not less than 96 per cent. of lead, £125; scrap cable sheathing, £123; other scrap containing not less than 96 per cent. lead, £119.

CUPRO NICKEL—70/30 process scrap, £220; 70/30 used condenser tubes, £180; 80/20 process scrap, £200.

BRASS—QF cases free from primers, £175; QF cases not free from primers, £169; SAA cases, mechanically treated or fired, £165; SAA cases, muffled or furnaced, £159.

Other prices and definitions are unchanged. The Minister of Supply states that the Order was made after full consultation with the many trade interests concerned, and he again appeals to the trade to ensure the most rapid and efficient use of scrap.

The American Copper Institute has published the usual monthly figures relating to copper, this time in respect of February. Production of blister copper in February was 82,912 short tons, against 87,109 tons in the previous month, while the output of refined at 101,199 tons was some 9,000 tons lower than the January total. Deliveries to domestic consumers amounted to 99,630 tons, compared with 108,128 tons in the first month of the year and much lower than the December total of 121,954 tons. Stocks of refined copper in producers' hands amounted to 59,324 tons, compared with 54,883 tons at January 31. This upward tendency is encouraging, for at the end of last year the total was below 50,000 tons. Outside the United States stocks at February 28 amounted to 151,288 tons, which also showed an increase of some 4,450 tons. Production of blister copper was 108,417 tons. Since February was a short month it would probably be wrong to presume on the evidence of these figures that there has been some setback in U.S. activity.

Although the turnover in tin last week was not large, the quotation moved between wide limits. The news that the U.S. Government is to be the sole importer and seller of tin in the future was apparently accepted in Whittington Avenue as a bull point for the metal, which had previously reacted severely on the news that stockpiling in the U.S.A. was to come to an end.

Official tin quotations were as follow:—

Cash—Thursday, £1,420 to £1,440; Friday, £1,325 to £1,330; Monday, £1,255 to £1,260; Tuesday, £1,280 to £1,290.

Three Months—Thursday, £1,160 to £1,165; Friday, £1,220 to £1,225; Monday, £1,150 to £1,160; Tuesday, £1,175 to £1,180.

Catalogues Received

Continuous Conveyor Furnaces. Birlec, Limited, of Erdington, Birmingham, 24, have just issued a catalogue dealing with the above subject. It is a very wide field and caters for many types of processes used in the metallurgical industries. It is a well-illustrated 16-page brochure and the pictures are often themselves very informative. A feature against which the reviewer confesses a personal prejudice is the use of composite pictures, as he believes overlapping detracts from clarity—so desirable in technology. Beyond that criticism the catalogue, which is available to our readers on writing to Erdington, is excellent.

Magnetic Sweeper. A leaflet received from R. J. Richardson & Sons, Limited, Commercial Street, Birmingham, 1, describes and illustrates a range of magnetic sweepers which will effectually rid pathways of potentially dangerous pellets and other ferrous scrap. The length of the magnetic drum which goes into the four models available ranges from 10 to 34 in.